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QUARTERLY

OF THE

National Fire Protection Association

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40 CENTRAL STREET, BOSTON, MASS.

National Fire Protection Association.

INTERNATIONAL.

Executive Office, 40 Central Street, Boston, Mass., U. S. A.

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Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Insurance Bureau.
Western Sprinklered Risk Association.
West Virginia Fire Underwriters' Association
West Virginia Inspection Bureau.
Wisconsin Inspection Bureau.

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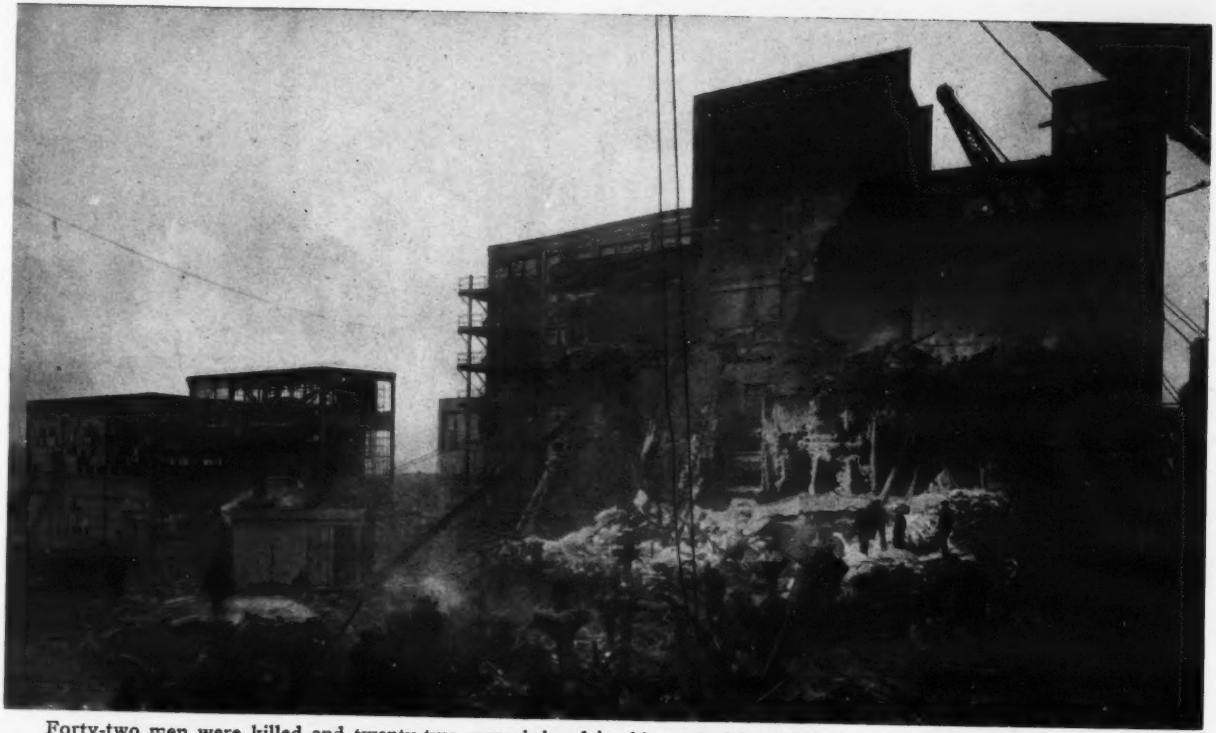
Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.



Forty-two men were killed and twenty-two were injured in this explosion of starch dust in a plant at Pekin, Illinois, on January 3, 1924. Rescue work, in progress when this picture was taken, was handicapped by the low temperature, 20° below zero, on the morning following the explosion. The force of the explosion is indicated by the ruins of the three-story brick building which formerly stood in the open space in the foreground. (For report see page 354.)

The Quarterly

Vol. 17 April, 1924 No. 4

Twenty-eighth Annual Meeting. The success of our annual meeting of 1922, both as to attendance and accomplishment, stamped Atlantic City as perhaps the most desirable place that can be chosen for our conventions in the East.

The headquarters and place of meeting this year (May 13, 14, 15) will again be Chalfonte-Haddon Hall, the two hotels under the same management on the sea front on opposite sides of North Carolina Avenue. Haddon Hall is the fine new structure that had not been wholly completed at the time of our last Atlantic City meeting. The sessions will be held in the beautiful Vernon Room as before. The official program to be mailed to members shortly and the announcements in the *News Letter* will indicate the budget of committee reports to be presented and other items of the meeting.

* * * * *

Atlantic City the Paradox. Despite the notion of gaiety that the name of Atlantic City registers upon the mind, it is in the zone of quiet. It is a place in which to rest or work: a place that actually goes toward intimacy and so in a direction counter to a broadcasting world. And it does this placidly without letting you know it. The long line of hotel coaches at the railroad station suggests hubbub; but its dissipation with yourself absorbed in it soon lands you in a quiet as profound as the top of a pillar. Atlantic City's colossal hotels are built upon an illusion; but not an unpleasant one. There is no harm in believing gregariousness to be gaiety, and men and women are always interesting to look upon. You can go out and mingle in the stream of the boardwalk if you like and absorb the essences of the crowd; but the crowd does not come to you nor thrust itself upon you. It doesn't fly at and squawk at you. It is there waiting for you when you want it. Meanwhile you may rest or you may work.

Another One Breaks Loose! The cynics of the N. F. P. A. office commonly escape the contamination of the literary drug traffic by consistent avoidance of all the fleet of sentimental "home" magazines published for unimaginative American middle-class consumption. But with the approach of spring, the beginning of the silly season, a review of these publications is usually made to see if the unconscious incendiaries are still enthusiastically showing people how to be burned alive.

Because the month of February is not a spring month we should have missed that issue of the *House Beautiful* were it not for our old friend C. P. Faunce of Salem, who remembers that there were men in that town before the conflagration who fought for the privilege of using wooden shingles and therefore that the fool killer sometimes takes a vacation in mid-winter. On page 156 of the *House Beautiful* for February a writer shows how to take out an old brick chimney condemned by the underwriters and put in a wooden flue open from the basement to the attic in order to make the house fire-safe and provide a dumb waiter and clothes chute at the same time.

The touch of sentimentality indispensible to home magazine literature is furnished by the writer making his wife the originator of the idea. She tells him about it, "clapping her hands ecstatically," and, says he,

> I looked down into the shining eyes which beamed up into mine with the assurance of approval revealing itself in their hidden depths.

That obviously did for him. He doesn't reveal the comment made by the underwriters who had advocated the removal of the chimney to make the house fire-safe, but the approval of the editor of the *House Beautiful* was obviously sufficient. The editor gave him the prize for it in "Contest No. 1" for the most ingenious feature added to a house already built and "designed to lighten the work of housekeeping." If a fire ever starts in the basement it will probably make housekeeping superfluous.

* * * * *

Motor Cars and Motor Cars. Bacon, who used to be quoted by our grandparents, but whom the world is now moving too fast even to read, once wrote: "a little philosophy inclineth a man's mind to atheism but depth in philosophy bringeth it about again to religion"; and Thomas Jefferson allowed that the cure for the ills of democracy is more democracy. Clerks who work in candy stores do not eat candy.

By the same token the motor car may yet render the motor car unpopular if not impossible. Those cities which, like Cincinnati, reduced their fire forces and fire stations with the coming of the automobile pumping engine and truck, because of the speed secured in running to fires, are

finding that other automobiles, that is to say, traffic congestion, is neutralizing the fancied gains. All the large cities face this problem. New York has it at its worst in the vicinity of Times Square when the theatres are letting out. The precious minutes that follow the turning in of a fire alarm before the apparatus can get on the job are being unavoidably extended. The vehicles designed for speed are making speed impossible.

* * * * *

Philadelphia Has a Plan. Philadelphia as far as fire protection is concerned is out to beat the handicaps of traffic congestion by making its down town districts less dependent on the public fire department. Automatic sprinklers in all basements of commercial buildings, and standpipes and hose in all buildings over six stories (with employees trained to use them) can do quite a little fire extinguishment on their own.

Philadelphia has a "fire chiefs' cabinet" in essence; that is to say, a fire prevention group of citizens of which Fire Chief Ross Davis is an integral part. Stewart A. Jellett (member N. F. P. A.) is the chairman of this organization and has been its chief protagonist. Before seeking local legislation to compel the protection of down town buildings in the interest of general safety, this group wished to make certain the city had the power to do this. It therefore sought and secured the passage of the following enabling act:

(No. 405) AN ACT authorizing council in cities of the first class, by ordinance, to require the installation of standpipes and sprinkler systems in certain buildings in such cities, to prescribe the kind and character thereof, and regulations therefor; and to provide for the enforcement of such ordinance.

Section 1. Be it enacted, etc., That for better fire protection in cities of the first class of this Commonwealth, the city council is authorized and empowered to provide, by ordinance, for the installation of standpipes in all buildings hereafter erected or altered of eighty-five feet, or six stories or more, in height.

Section 2. The council in said cities is authorized and empowered to require the installation of sprinkler systems in the basement of buildings hereafter erected or altered, to be used for stores, factories. or warehouses, in which the city council may determine such sprinkler systems to be necessary.

Section 3. The city council may prescribe the kind and character of such standpipes and sprinkler systems and the details of their installation, and may provide for carrying into effect and enforcing the provisions of such ordinance.

APPROVED—The 30th day of June, A. D. 1923.

GIFFORD PINCHOT, Governor of Pennsylvania.

A special committee of the local group with Charles A. Hexamer (member N. F. P. A.) at its head, and Fire Chief Ross Davis, a member, is now seeking to obtain the passage of an ordinance under this act that will secure for Philadelphia the protection the passage of the above bill was intended to provide for.

Forest Fire Prevention. Forest Protection Week, proclaimed by President Coolidge for April 21-27, 1924, is for the purpose of educating the public in habits of carefulness in the woods. Forest fires contribute a considerable part of the total fire loss of the United States and Canada and all N. F. P. A. members should support the forest protection movement, the importance of which needs no comment here. Forest fire protection is of course included in the general objects of the Association and much attention has been given to it from time to time (e.g. QUARTERLY, October, 1923, page 108). This subject has, however, been covered so comprehensively by various government agencies that there has been a tendency for us to give it relatively little consideration, concentrating our limited resources in other fields. As a result forest fire protection is often considered a separate subject, not directly related to fire protection for man-made property. For example, the fire loss statistics appearing on another page of this QUARTERLY do not include forest fire losses. Comparatively few forest protection authorities are members of the N. F. P. A. Forest Protection Week in the spring is entirely unrelated to Fire Prevention Week in the fall.

This situation is unfortunate, as much might be gained by a closer relationship between forest fire prevention and fire prevention in general. The main problem in both cases is education and the promotion of carefulness. The same careless smoker may cause fires in the woods and in cities. A joint campaign to make him always careful should be more effective than the present disjointed efforts, to prevent his smoking in the factory where there are flammable materials, and the separate independent attempt to make him careful with fire when he is in the woods. Let us, therefore, at every opportunity co-operate in the furtherance of forest fire prevention, with the knowledge that properly applied efforts in any branch of fire prevention will eventually bear fruit in contributing towards the reduction of losses in every class of property.

* * * * *

"Personal Liability" for Forest Fires. A recent court decision in California where the cost of forest fire extinguishment was assessed on those responsible for starting a fire, apparently the first of its kind on record, strengthens the legal precedent for "personal liability" decisions, and serves as an example of the way in which forest fire protection activities often benefit the cause of fire protection in general.

The *San Francisco Examiner*, under date of March 7, 1924, describes this case as follows:—

> Assistant United States Attorney Alma Myers won her first jury trial yesterday when George Bubresko and Mitchell Resetar of Watsonville were ordered to pay the Government $2,500 as the cost of

fighting a forest fire which they started. The case was tried in Federal Judge George M. Bourquin's court.

Evidence showed that Bubresko and Resetar had started a brush fire to destroy the body of a doe which they had killed by mistake while hunting in Santa Barbara National Forest near Tassajara Hot Springs, Monterey County.

The fire got beyond control and burned over 2,000 acres before it was finally extinguished after several days' fighting.

The case was the first on record here where the Government sued to recover money expended in fire fighting.

* * * * *

The Servitors of Men. The exponents of that materialistic philosophy which declares that the humanities of the world have been advanced by science and not by the teaching of ethics, point to the liberation of the horse as a conspicuous example. Electricity and gasoline have largely lifted the burdens from the backs of these devoted animals, for centuries the most faithful helpers and the worst abused. The death of horses in burning stables has dramatized man's inhumanity all down the centuries, and even at this date in Boston where Postoffice Square is graced by a fountain and shaft to commemorate the success of the Society for the Prevention of Cruelty to Animals and every holiday season the maudlin sentimentality of Boston expresses itself in a decorated and lighted Christmas tree for the horses alone, there exists an apathy and insensibility toward the physical welfare of these animals that gives ample warrant for the jibes of cynical persons so often directed against organized and official humanitarian movements.

Some years ago the fire prevention commissioner of the Boston Metropolitan District, John A. O'Keefe, who is now dead and whose office is abolished, attempted with the assistance of local members of the N. F. P. A. to induce the legislature to pass a bill prohibiting the stabling of horses above or below the street level. The Boston landlord interests fought and defeated the measure assisted by the indifference of the country legislators whose constituents do not stable their horses in second stories and basements.

Last July in a Boston fire 82 horses were burned to death. Moved by the cruelty of this the mayor of Boston put a bill into the present legislature. The bill was "referred to the next General Court", (the Massachusetts legislature is called the General Court) which is the political method of smothering a measure. The mayor of Boston is not popular on Beacon Hill and it is assumed the bill was thus disposed of because he was its proponent.

Wednesday, April 2, a stable was burned in Roxbury and 48 horses lost their lives. On Thursday, April 3, the governor of Massachusetts in a special message urged the legislature to reconsider the proposed

legislation and enact it without delay. The governor's message was an effective plea for the horses, "the servitors of men." The rightness of Mayor Curley's bill, or at least the rightness of its object, had been cruelly demonstrated. Governor Cox said: "It is revolting to hitch horses in places where in case of fire they must await agonizing death, with no opportunity of escape." Had the legislature been willing to consider Mayor Curley's bill on its merits, the governor's message would not have been necessary.

Meanwhile it might be suggested to the Society for the Prevention of Cruelty to Animals even at this late date that the protection of horses from collective death by fire might be as humane though perhaps not so spectacular an activity as the arrest of teamsters for beating their horses in the street.

* * * * *

Another Hospital Hazard. With every advance in the arts and sciences there seem to come new fire hazards, not popularly appreciated until demonstrated by some disaster. No sooner is one hazard discovered and safeguarded than the rapid development of science brings forth a new one. In the field of industry the manufacturer, anxious that nothing shall interrupt the continuity of production, is gradually being educated to inquire into and to safeguard the hazards of new processes as they are developed. In the field of medicine, however, such awakening seems to have been slower. Hospital buildings, with the exception of some modern city structures, are, as a class, of hazardous construction, including a very considerable proportion of downright fire traps.

The nitro-cellulose X-ray film, largely used in hospitals, constitutes a severe hazard unless properly stored and handled. (See editorial in October, 1923, QUARTERLY, page 104.) This hazard within the past few months has been to a considerable extent recognized by the more progressive hospital authorities. Compliance with the tentative regulations on this subject, which are to be presented to the Association at Atlantic City by the N. F. P. A. Committee on Hazardous Chemicals and Explosives, will do much towards eliminating this particular danger to the sick and helpless.

The general use of ether as an anaesthetic always involves a fire and explosion hazard, but ether has been in use so long that its properties are generally known and as a result few ether fires or explosions are now reported. Ether has never been considered from a medical viewpoint an entirely satisfactory anaesthetic and now a new anaesthetic, ethylene, is being introduced. Ethylene seems to be inherently more dangerous, from the standpoint of fire hazard, than ether, and the method of its use in connection with oxygen makes it especially explosive. The danger in-

volved is well illustrated by a recent explosion in a Baltimore hospital which resulted in the death of the patient under the anaesthetic. This is reported by Member Carl W. Wheelock as follows:

> On March 14, 1924, an explosion occurred in the operating room of the hospital during an operation in connection with a carbuncle on the neck of a patient.
>
> The patient was lying on the operating table, face downward, with a bag of sand under his chest, in order to keep his head raised slightly. Windows in the operating room were open to allow a free circulation of air. The anaesthetic, ethylene gas, was administered by a specialist in this line. The funnel, or inhaling device, was placed over the patient's face and as it did not fit tight, a moistened towel was placed around the funnel and the patient's face. The doctor administering the anaesthetic was under the operating table so he could properly control his apparatus and watch the glass bottles through which the ethylene and oxygen passed. According to the statement of this doctor, the apparatus was working perfectly when the explosion occurred.
>
> It has been learned that an electric cauterizing needle, with an exposed incandescent point, had been in use for about five minutes, when the explosion occurred. It is thought that the explosion took place in the funnel or inhaling device over the patient's face and in his mouth. The force of the explosion split the rubber bag containing the mixture of ethylene and oxygen, which the patient was inhaling, but did not communicate back to the ethylene tank. The patient died shortly after the explosion.
>
> Definite cause of the explosion has not been proven, but it is presumed that there was a leakage of gas from around the funnel, which became ignited by the cauterizing needle. This probably flashed back to the confined gas in the funnel, thereby causing the explosion.

* * * * *

The Annual Sprinkler Tables. Near the end of this issue of the QUARTERLY will be found the twenty-eighth annual summary of the reports on fires in properties under automatic sprinkler protection. This tabulation of automatic sprinkler performance dates back to the very beginnings of the Association. It was initially a simple list compiled as a summary of fire experience for reference in connection with the formulation of automatic sprinkler requirements, one of the principal functions of the Association when first organized. Since 1897 the annual summary has been enlarged from time to time, to include tables on various additional phases of automatic sprinkler performance, until now it includes 15 separate tables in which the data from reports of 31,028 fires is tabulated. These tabulations have served a very valuable purpose in conclusively demonstrating the efficiency of the automatic sprinkler as a fire extinguishing device, and by indicating the reasons for the comparatively few sprinkler failures that do occur, has helped point the way towards the further improvement of this most efficient of all fire extinguishing devices. The principal purpose of this

elaborate tabulation seems now to have been accomplished, the automatic sprinkler has been established in an unassailable position, and it has been so standardized that the results of the tables show surprisingly little variation from year to year. A comparison with the similar tables published last year shows variation in most cases of only a fraction of one per cent. It seems likely, therefore, that the newly appointed Committee on Fire Record will recommend that this annual sprinkler tabulation in its present form be discontinued, that the tables be reduced in number or be simplified so that the labor now expended in compiling them may be released for the compilation of other fire record data now needed in connection with the solving of current problems. It is not likely that the annual tabulation will be discontinued altogether, as it serves as a valuable reference for many purposes, but it may be expected that this is the last year that the tabulation will appear in all its present detail.

And the villain still pursued her
The Fire Fiend–
and Miss Prosperity

Courtesy Whittlings.

Meeting of Executive Committee.

The midwinter meeting of the executives was held in Atlantic City on February 2, 1924. The following members were present:

Albert T. Bell, Atlantic City, Chairman.
W. F. Ballinger, Philadelphia.
Geo. W. Booth, New York.
Edward R. Hardy, New York.
F. B. Quackenboss, Nashville.
A. M. Schoen, Atlanta.
W. F. Steffens, New York.
H. O. Lacount, Boston, President.
Rudolph P. Miller, New York, Vice-President.
Dana Pierce, Chicago, Vice-President.
Franklin H. Wentworth, Boston, Secretary-Treasurer.
F. J. T. Stewart, New York, Past President.

Business Transacted.

The program for the annual meeting, May 13, 14, 15, was discussed, and the following reception committee was appointed with authority to add to its number:

W. F. Steffens, Chairman; Albert T. Bell, William S. Boyd, H. L. Miner, G. E. Stecher, Howard L. Stanton, H. V. Thayer.

It was voted that the subject of the creation of the proposed class of professional members be included in the report of the Executive Committee for discussion at the annual meeting.

The chairman of the Electrical Committee reported completion of the Sectional Committee of the American Engineering Standards Committee created for reporting the National Electrical Code to the A. E. S. C. for registration as an American Standard.

Following receipt of communication from the National Board of Fire Underwriters on the subject, the action of the Executive Committee on June 20, 1923, approving the recommendations of the Committee on Flammable Liquids respecting amendments to the Regulations governing the Installation of Containers for Storing and Handling Flammable Liquids was discussed and such action re-affirmed, the Secretary being requested to explain to the National Board the circumstances of and reasons for such action.

The plan of the Finance Committee for securing funds for maintenance of one or more field secretaries by voluntary subscriptions from members of the Association was endorsed; the form letter to members who are large insurers of property drafted by the Chairman of the

Executive Committee was approved and the form of subsequent appeals left to the judgment of the Finance Committee.

It was voted to request the Committee on Articles of Association to recommend to the next annual meeting the elimination of Article 14 providing for the creation and maintenance of local chapters; the following committee being appointed to confer with officers of the New York Chapter on the subject: F. J. T. Stewart, Rudolph P. Miller, E. R. Hardy, W. F. Steffens.

The following organizations were elected to membership:

American Water Works Association
American Association of Oil Burner Manufacturers
Central Station Fire Protection Association.

The following recommendations of the Committee on Field Practice for amendment to "Suggestions for the Organization, Drilling and Equipment of Private Fire Brigades" were approved:

Add to Paragraph 22:

"In addition to the plant fire alarm system, suitable arrangements should be provided for calling the nearest municipal fire department, by means of a fire alarm box or by other method appropriate to local conditions."

Add to Paragraph 48:

"Before hose is taken for testing or is removed from the hose station for any purpose, it should be replaced by spare hose so that the required amount of hose will be always available at each hydrant."

The authority of representatives of organization members on the Electrical Committee to commit such members to support of the rules of the committee as expressed in the National Electrical Code, and the feasibility of more frequent meetings of the committee and revisions of the code, were considered without action.

It was voted to approve the recommendation of the Committee on Automatic Sprinklers that the following paragraph be printed conspicuously in the Regulations governing Sprinkler Systems:

The term "Sprinkler System" should not be applied to all types of automatic extinguishing systems which may make use of the automatic sprinkler but should be confined to those widely recognized and generally accepted automatic sprinkler equipments covered by these regulations and furnished with a primary water supply.

Following discussion of communication from Marine Committee respecting proposed special tests to determine degrees of explosion or fire hazard of bulk oils, the secretary was requested to advise the Marine Committee of the inability of the Association to promote such a test program.

Following discussion of a communication from the Director of the U. S. Bureau of Standards respecting a proposed program for testing gas appliances for approval, the secretary was requested to advise the Director of the Bureau that while the Executive Committee cannot assume to

speak for the organizations constituting the N. F. P. A., it is their opinion that no program such as that outlined in the Director's communication is a desirable one for any department of the federal government to undertake.

At the request of the Committee on Docks, Piers and Wharves, its title was changed to "Piers and Wharves," and the suggestion of its chairman that the American Society of Civil Engineers be urged to appoint a fire prevention committee was endorsed and referred to the secretary.

H. P. Smith of Hartford was appointed chairman of the Committee on Field Practice in place of Edward R. Hardy of New York resigned; Sidney J. Williams was appointed chairman of the Committee on Safety to Life in place of H. W. Forster resigned; and sundry changes in the personnel of other committees were made on recommendations of the chairmen thereof.

A vote of thanks was tendered to the management of Chalfonte-Haddon Hall for its generous hospitality and unusual courtesies extended to the Committee.

New York's Clean Up Campaign.

Canal to 34th Streets, Manhattan, January 7-21, 1924.

By F. J. T. Stewart.
(Member N. F. P. A.)

Influenced by a steady increase in the number of fires in Manhattan during the first half of 1923 and the opinion of Fire Chief Kenlon that the most important part of this increase had occurred in the district between Canal and 34th Streets, an extra force of inspectors was assigned to this territory, in September, 1923, under direction of the Committee on Surveys of the New York Board of Fire Underwriters. The first analysis of the results of this intensive inspection work, made about 90 days after its start, showed conclusively that careless housekeeping with consequent lack of cleanliness and a general disregard of the law prohibiting smoking in factories created a most dangerous fire hazard. Other defects found were relatively unimportant when compared with the abnormal fire menace created by these two conditions.

It was at once decided to make a far more intensive drive in this district directed particularly against these two highly dangerous conditions in factories, their seriousness having been confirmed by the fire record which showed the majority of all fires to be due to these two causes alone. An inspection force of some ninety men started January 7, 1924, on a most intensive Clean-Up Campaign directed primarily against carelessness and unlawful smoking. The inspectors were addressed by

Fire Chief Kenlon and Fire Marshal Brophy who promised their full support and co-operation.

Within about two weeks the inspection work was practically completed. The scope of the work may be indicated briefly by the following summary of conditions as reported by the inspectors.

Total Inspections	14,958
Number of factories in satisfactory condition	11,269
Number of factories in unsatisfactory condition	3,689
Number of factories where housekeeping was not satisfactory	3,591
Number of factories where regulations on smoking were not satisfactory	3,141
Number of factories in which "No Smoking" signs were not displayed	7,080

City officials extended substantial support and co-operation. Reports of dangerous conditions submitted to the Fire Commissioner were promptly followed up by inspectors of the Bureau of Fire Prevention.

In the month of January, 38 persons were arraigned in court for smoking in factories. Twenty-one were fined a total amount of $420. Sentence was suspended on 17 cases. In the month of February, 48 persons were arraigned in court for smoking in factories. Forty-five were fined a total amount of $950. Sentence was suspended on three cases.

The campaign clearly indicated that the New York State Labor Law for protection of employees was in many cases ignored. The law requires the posting of "No Smoking" signs and about one-half of the factories visited had no signs. The survey also indicated the necessity for improvement in the conditions surrounding rubbish removal and disposal. The beneficial results of this campaign have been immediately apparent in a reduction in number of fires in the district covered. In this territory the number of fires in factories has been 25% less in 1924 than in 1923, although the aggregate number of fires in Greater New York has shown an increase during the same period of 1924 as compared to 1923.

It is intended to follow up the campaign with a second drive in the near future.

Carelessness and the Fire Loss.

By Charles E. Worthington.
(Member N. F. P. A.)

The people of North America are said to be the most careless on the earth. We certainly do burn a large percentage of our destructible property, a far larger proportion than do the civilized peoples of Western Europe, the very people from which the larger portion of our population is derived, and the statement is freely made that eighty per cent of our total fire loss is due to "carelessness." It is evident, however, that this term "carelessness" is here used in a much broader sense than any dictionary definition would warrant, that it must signify something more than the lack of "ordinary prudence" and it is of interest to inquire as to what it really does include.

Consider the wooden shingle roof, which, statistically, is responsible for about ten per cent of our annual fire loss. It is only one of the thirty odd causes of fire enumerated in classified lists, but it is an important cause and a convenient starting point for this analysis.

Just where, in the case of the shingle roof fire, does the element of carelessness come in? Is the menace of constructing or acquiring a shingle roofed house a careless act or is the carelessness to be traced back to the producer of shingles, to the architect or builder who designed the structure and perhaps specified the material, or to the dealer who sold it? Just where does the responsibility rest and how may it be fixed or determined?

A property owner is about to build a house. Suppose we have free access to him and can present the case against the inflammable roof covering. The owner employs an architect who specifies a wooden shingle roof; he does not consider them a hazard. Indeed a considerable number of architects, a large number of builders and contractors, and a vastly larger number of lumber producers and dealers laugh to scorn the idea that there is any especial fire hazard in shingle roofs and will even deny the validity of our statistics, sometimes producing home-made counter statistics. So the prospective builder must choose between our view, backed by disputed statistics, or the view of a score or more of men he knows and trusts (although some of these may be directly interested in the production or sale of wooden shingles). To clinch the matter the wooden shingles may cost less than fire retardant roofings. Is this man "careless" if he chooses wooden shingles?

Next consider the case of the man who buys a house already built with a wooden shingle roof, in a district where all the neighboring houses have similar roofs. Later a child or a servant burns waste paper in the furnace of a house in the next block; the roofs are dry and a chance wind blows a burning fragment of paper upon the man's shingle roof and it ignites. Was the purchase of this house and the failure to replace at once a sound shingle roof with one of fire-resistive material a careless act, or does the carelessness rest with the person who burned the paper in the furnace never suspecting any possible ill results?

If we can possibly stretch the meaning of "carelessness" to include such actions and occurrences as these, shingle roof fires may be included in the eighty per cent, but if we can concede that the acts may be permissible within the limits of ordinary prudence we cannot well do so, and it really does not appear that any of these acts could be held to include lack of ordinary prudence.

By a similar line of reasoning it may be shown that fires classed as due to defective chimneys and flues are not properly caused by "carelessness." We may not reasonably suppose that the builders knowingly built in a dangerous manner or in one they considered likely to become dangerous, and incompetence and ignorance can hardly be construed as carelessness since the work, such as it was, was doubtlessly done with care. It is not exactly fair to brand one as careless for not knowing that which they had no opportunity to know.

Incendiarism accounts for about five per cent of the total fire loss. There is no carelessness here for as a rule the most painstaking care is exercised in preparing for the event and avoiding detection.

If we exempt shingle roofs and defective chimneys and flues from the scope of "carelessness" and likewise, as we must, exclude incendiarism, we have accounted for fully 20 per cent of the fire loss, and since the remaining classified causes are largely causes due to ignorance, or fortuitous circumstances, such as conflagrations, possibly traceable in cases to some careless act in their inception but rarely in their spread, we will be forced to the conclusion that 80 per cent is an over estimate which should be considerably reduced. Perhaps it is an exaggeration for the laudable purpose of lending emphasis to the deplorable results of carelessness, but it is, nevertheless, an exaggeration.

There is really no sound basis for estimating just what proportion of the fire loss is due to carelessness. Some recognized causes like "matches —smoking" are practically all personal carelessness, while in other instances the proportion is very doubtful. Probably a fair estimate is that carelessness is responsible for 40 per cent, poor and inadequate construction 40 per cent, simple ignorance 10 per cent, and unforeseen and

practically unforeseeable conditions and purely fortuitous circumstances 10 per cent.

Forty per cent, or about $200,000,000, of fire loss presumably due to actual carelessness is bad enough, and indicates either a state of mind far from normal or some defect in our laws and customs, perhaps both; but it is apparently more a "state of mind" than otherwise, since carelessness is a mental defect. What is the reason for this difference of mental attitude between the people of North America and of Western Europe? We must determine this, certainly, before we can suggest proper remedial action.

The true explanation probably is to be found in a number of different causes. Perhaps the most obvious of these lies in the irresponsible attitude induced by the living conditions in our cities, where a large proportion of the population are apartment or tenement dwellers, who have no responsibility for their homes, and who are all too prone to spend their substance in automobiling and other pleasures rather than devoting their savings to the purchase of homes which would bring a sense of personal responsibility with the ownership of property. Here is in a general way a distinct loss of personal responsibility and the more irresponsible the average man grows the less careful he will be. Why should he care, if fire results from his negligence or oversight; the landlord and the insurance companies will carry the burden, "he should worry."

This is one factor productive of careless habits to some extent at least, but it is only one. Another is that we are intrinsically not a law abiding or docile people. The Western European peoples, accustomed for many generations to personal subservience to the rule of "stormy" governments, are far more docile. But unfortunately they lose much of this docility when brought across the seas, perhaps because their ideas of liberty include more personal freedom from government surveillance and personal control.

Our national traditions largely descend from our colonial predecessors and they entertained few if any scruples as to the propriety of disregarding or disobeying laws they did not like. There was for instance legal prohibition at one time, not of alcoholic liquor but of textile manufacturing. It was easy for the Government to close the few existing factories but thereupon home spinning and weaving became as universally popular as home brewing at a later date, although in both cases falling within the prohibition. "Obey the law because it is law" seems to have been a current exhortation then as now.

Then there was the "Boston Tea Party" which could hardly be regarded in the light of a mass meeting to promote the observance of existing law. In fact the whole colonial history abounds in resistance to or

evasion of unpopular laws. The righteousness of the spirit of resistance to obnoxious law was regarded with favor by some of the founders of the United States, among them Thomas Jefferson.

Also we have magnified the importance of motive and intent. The laws of God and Nature, of cause and effect, do not recognize this; whoever touches hot iron burns his fingers whether the contact was intentional or otherwise. This revolt from the harsher old world law began early, as one recorded instance in the earlier days of Plymouth County in Massachusetts serves to indicate. In this case an Indian was conclusively convicted of attack upon a white woman and the judge before whom he was brought for sentence observed that there was no doubt as to his guilt and if he were a white man he would punish him severely but seeing that he was an Indian and did not know any better he would let him go.

Fire prevention literature contains frequent references to the operation of French or other foreign law, cases where persons having unwittingly caused fires through sheer ignorance or neglect have been brought before magistrates and punished. We do not do this in America. Here the accused would be entitled to a trial by jury; the case would usually turn on the intent and acquittal would follow.

All nations through their traditions and customs in time acquire a characteristic point of view toward the affairs of life, a national state of mind, and all that has here been said has been said merely with a view to demonstrating that the state of mind of the United States and Canada is built of different factors from the mind of the average European nation, this state of mind that not only determines in a large measure the nature of the laws but in a larger measure their execution.

We might compare the situation to two men sitting down to dine, one to a table upon which is placed only so many dishes of food as he can and will consume without distress, the other to a table so loaded with a multiplicity of foods far beyond his power of consumption that he must perforce pick and choose such quantity as he can consume, naturally at the same time exercising preference. We have so many laws that we can not possibly understand or remember more than a fraction so the average American selects such laws as he thinks he would like to observe and lets it go at that; so unpopular laws fare badly.

Naturally when a man finds that he is not held responsible for his failure to observe laws and for his carelessness there is no impulse toward reform. He does not realize any sense of responsibility, especially if an insurance company assumes the burden of his errors, without cost or inconvenience to him.

We may conclude therefore that "Carelessness" is one manifestation

of a national state of mind, some features of which we may eventually outgrow by natural processes.

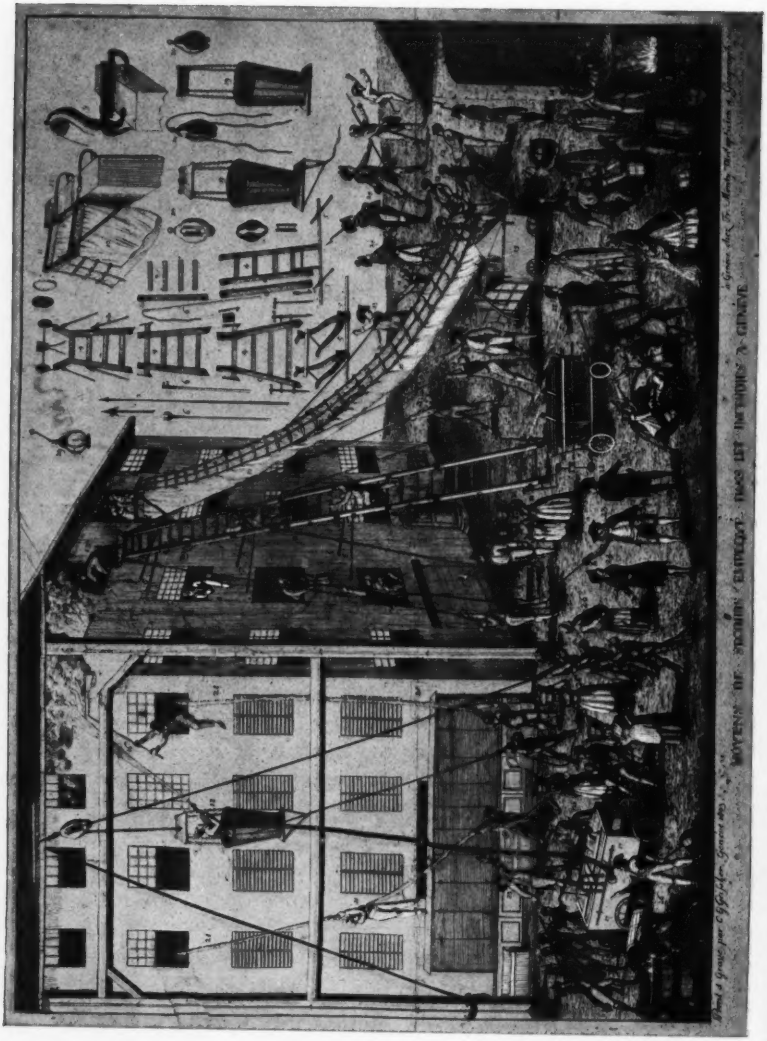
We have some so called "personal liability laws" none of which are so framed as to make careless persons directly responsible, but set up a responsibility for non-compliance with official demands. When the official finds evidence of carelessness he may direct that such condition be remedied and the offender may be punished, not for his carelessness but his failure to obey authority. In reality these laws do not re-establish the lapsed doctrine of any personal liability but merely confer some specific authority upon certain officials. But granted the efficiency of foreign "personal liability" laws and their operation, any attempt to introduce like methods here would be resented bitterly. We will tolerate as a rule much restraint as concerns our conduct and relation to each other but we resent control of individual conduct in other respects.

We are not altogether to blame for our lack of docility since it is very largely inherited and we are bound by our tradition, but unfortunately the attitude is highly contagious as regards new comers "throwing off the shackles of old world despotisms" and seeking "liberty."

It would be very difficult, if we give credence to what statistics we have, to establish even a plausible argument to the effect that 75 per cent or 80 per cent of our fires are the direct result of some careless act, nor is it likely that any such proposition could be sustained should we explain "carelessness" to include ignorance, negligence, inattention and general inefficiency. But if we are privileged to follow back the train of events leading up to any one accident we are likely to find in some act of negligence or inattention the controlling factor, and in that sense, probably fully 95 per cent rather than 80 per cent of our fire loss is due directly or indirectly to something of this sort.

There seems to be no remedy in sight except in trying to educate all individuals to the belief that they alone are responsible for what they do and endeavoring meantime to so order matters that it will become increasingly difficult to shift the responsibility upon others. This cannot well be done by police regulations but perhaps a way can be found. At any rate the main work of reform will have to be accomplished without the aid of legislation. Making people good by legislation is impossible, for while legislatures can control to an extent the actions of men they have no control whatever over their minds and the evil we are contending with lies largely in mental attitude.

One thing we not only can do but are doing, we are reforming our building construction in a way to counteract much of the effects of carelessness, which together with our educational efforts ought to result in decreasing fire losses. Looking back for twenty-five years we have no reason to be ashamed of the progress made even though it falls far short of our intentions.



Fire Fighting in Geneva in 1789.

The remarkable illustration shown on the opposite page appeared in a recent issue of *La Prevention du Feu,* fire prevention monthly published in Paris. The editor courteously supplied the illustration for reproduction in the QUARTERLY. Captain William Keller, Chief of the Geneva Fire Department, has furnished the following interesting description.

This picture represents the scene of a memorable fire in a dwelling house in Geneva (Switzerland) during the winter of 1789, which was a particularly severe one. Everything was frozen up and in order to be able to pour water on the fire it was necessary first to thaw the ice by means of bonfires built on the street.

The artist, C. G. Geissler in Geneva, has left us here a very precious document abounding in details and without the least trouble one can follow the work of the rescuers.

One is astonished at the richness and the variety of the means of aid employed more than a century ago. The mutual help of the inhabitants is touching, the woman of rank fraternizes with the woman of the people, the magistrate brings his help as well as the workman; all fight against the conflagration with the same enthusiasm and ardor.

Key.

1. Wood ladder made up of several pieces, one fitting into the other.
2. Ladder braces.
3. Firemen holding the ladder straight while others are ascending.
4. Sections of the ladder.
5. Device used in assembling the ladder.
6. Various types of ladder braces.
7. Wagon carrying all the sections of the ladder.
8. Way of passing a lantern from one window to the other attached to a rope to draw up the crane.
9. Crane which, after being fastened to the window with an iron clamp, is used in raising the cloth chute.
10. Cloth chute.
11. The mouth of the chute with its iron clamps. More detailed view.
12. Firemen holding the chute stretched out.
13. Way to enter the chute.
14. Firemen holding the chute with ropes.
15. Wagon containing the chute and its accessory parts.
16. Way to break the windows with a chain in the form of a whip.
17. Fire pump in action.
18. Basket containing a fireman with a hose.

19. Various views of the basket.
20. Pulley used to raise the basket.
21. Rope provided with wool knots to slide with the help of a belt and without burning one's hands.
22. Magistrates acting as policemen at the fire.
23. Officers of the fire brigade.
24. Officers and special constables recruited from public-spirited citizens.
25. Messengers transferring the orders of the magistrates.
26. Men and women carrying water.
27. Ladies throwing sand and ashes on the ice in order to avoid falling.
28. People heating the water to prevent freezing.
29. The large lantern and its hook, attached to the top piece of the ladder in order to guide those mounting the ladder.

The Parking Problem.*

The parking of automobiles in streets and alleys in congested districts creates a fire hazard which is steadily becoming more serious in all American cities. Although much thought has been given by fire departments to the problems presented and many remedies have been applied, no municipality, so far as we have been able to learn, has, as yet, put into effect a complete and satisfactory plan. This is undoubtedly accounted for by the fact that city streets have not been seriously congested by traffic until the last few years.

Parking seriously affects a fire department in many ways. Among the important problems presented, according to reports received from 130 American cities, are the following:

1. The parking of automobiles in streets in congested districts has resulted in many collisions and made it necessary for some cities to pay damage claims arising from injury to persons and property caused by the operation of fire apparatus through streets in answer to alarms.

2. As a result of such parking the fire departments of many cities have experienced serious delays in getting to fires as the progress of fire apparatus has been impeded by traffic congestion.

3. After fire apparatus has arrived at fires it is often impossible for firemen to lay lines of hose and to place and raise extension ladders without first moving parked automobiles.

4. Automobiles parked in alleys not only retard passage of fire apparatus, delay the laying of lines of hose and the raising of ladders but greatly lessen the efficiency of fire-escapes, as many times cars are parked under swinging sections.

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* Extracts from Report 975 of the New York State Bureau of Municipal Information entitled "City Regulations to Eliminate Fire Hazards Resulting from the Parking of Automobiles in Streets and Alleys"—January 24, 1924.

5. The practice of motorists of following apparatus to a fire and stopping or parking within a short distance of the fire, hampers the work of firemen and often makes it very difficult for apparatus answering a second, third or fourth alarm to get within working distance of the fire.

Accidents and Delays Enroute to Fires.

That the parking of automobiles in streets in congested districts results in accidents and causes serious delays to fire apparatus enroute to fires is conclusively shown by the experience of American cities. Forty-seven report that they have had serious accidents. Most cities are not liable for damages resulting from the operation of fire apparatus through streets, as they are specifically exempted by State law. Several cities, however, report that they have paid damage claims, but some of them state that such claims have been paid only when the accident was due to the carelessness of the fire department drivers.

Reports show that the parking of automobiles in congested streets not only has caused serious delays to apparatus enroute to fires but the situation is becoming more serious daily. Fifty-four cities report that they have experienced serious delays. Even in many cities which have so far experienced no serious delays, the departments say that parked cars have somewhat delayed apparatus, and the officials of many realize that unless an effective remedy is soon applied the hazard will become more serious and accidents will occur.

Various remedies have been adopted by American cities to eliminate accidents and delays to apparatus enroute to fires and resulting from the parking of cars in congested streets. A summary of these follows:

1. Allow parking on only one side of congested streets.
2. Limit time of parking in congested streets.
3. Establish one way streets.
4. Widen streets.
5. Prohibit parking in congested districts, or during busy hours.
6. Provide public parking places other than streets.
7. Require automobiles to keep out of way of fire apparatus.
8. Prohibit parking within certain distance of fire hydrants and street intersections.
9. Require cars to park on side of street opposite to side that hydrants are on.
10. Prohibit parking in alleys.
11. Permit parking only in single file and parallel to the curb.
12. Prohibit parking opposite construction work.
13. Establish fire routes and allow no parking within 50 feet of certain corners on these routes.
14. Prohibit parking within 125 feet of street corners where trolley cars stop to take on or discharge passengers.
15. Prohibit parking on either side of street within 50 ft. of center point of front wall of fire station.
16. Conspicuous marking of hydrants.
17. Require a certain distance between cars parked parallel to the curb.

18. Permit only center parking where streets are wide enough.
19. Prohibit parking within certain distance from center of entrance of public buildings and theatres.

Interference with Apparatus and Firemen at a Fire.

Seventy cities report that parked cars have seriously interfered with the laying of hose, the placing and raising of extension ladders, the operation of apparatus, and the work of firemen at fires. Nearly all cities say that they have to move parked cars before they can operate at most of the fires. The seriousness of the problems presented by parked cars near a burning building is shown by the following experiences reported by cities:

Augusta, Ga.—"Three cars had to be moved before we could raise extension ladders."

Des Moines, Iowa—"We have been obliged to move cars many times in order to do efficient work. This necessarily means delay."

Grand Rapids, Mich.—"Generally have to operate at great disadvantage. Nearly always have to set too far from curb and almost invariably have to move cars to get a position at all."

Jamestown, N. Y.—"On several occasions we have had to move cars from vicinity of fires to enable men to work."

Waterbury, Conn.—"At a recent hotel fire in the heart of the city parked autos interfered with the progress of firemen, and this and high tension wires blocked us in our effort to raise extension ladders."

A surprising fact is that exactly one-half of the cities report that nothing has as yet been done in respect to automobile parking to eliminate interference with apparatus and firemen while working at fires. The departments of many of these cities, however, realize the seriousness of the situation as their replies plainly show they recognize that existing conditions permit such situations to develop.

Those cities which have endeavored to solve the problem have sent us valuable information about what they are doing and what they think should be done. The following is a summary of the regulations cities have put into effect in an effort to prevent interference with fire apparatus:

1. Prohibit parking in alleys.
2. Prohibit parking of cars within 600 feet of fire apparatus.
3. Depend on men in police and fire departments to clear the way.
4. Restrict the hours of parking.
5. Require cars to park single file, parallel to the curb and a certain distance apart.
6. Prohibit parking within certain distance of hydrants.
7. Prohibit parking in congested districts, or in main business or heavy traffic streets.
8. Limit time of parking.
9. Restrict parking to one side of street.
10. Park cars at angle as they can be more easily moved than when parked parallel to curb.
11. Require all trucks to load and unload from alley entrance.
12. Establish one way streets.
13. Prohibit parking for at least 100 feet in center of each block.
14. Require center parking when possible.
15. Prohibit parking within certain distance of entrance to public buildings and places of assembly.

All of the remedies that are now being tried and are given in the above summary are suggested by the cities in answer to the Bureau's request for suggestions about what cities can do to eliminate interference. In addition the following suggestions have been received:

1. Prohibit parking within three blocks of a fire.
2. Compel drivers to remain in cars when parked in congested district.
3. Prohibit locking of parked cars.
4. Provide parking space.
5. Widen streets.
6. Prohibit backing to curb, to load or unload, unless it is necessary to use skids.

Parking in Alleys.

The reports of cities show that the parking of automobiles in alleys has retarded the passage of fire apparatus, interfered with the work of firemen, and lessened the use and efficiency of fire-escapes. They also show that many cities have found and adopted an effective solution of this problem. The departments of 29 cities report that they have had trouble of this kind. Although 83 cities say that either they have not experienced delays or interference or that such trouble as they have had has not as yet been serious, the reports of nearly one-half of these show that alley parking has been prohibited in their cities or that no alleys exist. Some cities report that they have trouble in keeping automobiles out of privately owned alleys. Others say that they prohibit parking in such alleys and have no trouble. A few cities which have barred alley parking report that they are having trouble either because the regulation is not enforced or because violators are not sufficiently punished by the courts.

A majority of the cities report that they prohibit alley parking absolutely or in part. Some prohibit such parking except when the alley is wide enough to insure free passage or for purposes of loading and unloading.

Following Apparatus to Fires.

Complaints have been received from many cities about the practice of automobilists following apparatus to fires and parking their cars so as to interfere with the work of firemen and to congest nearby streets, thereby making it very difficult for additional apparatus to get near the fire. Several cities report that this problem has been solved by the enforcement of two regulations. One prohibits autoists following apparatus until such apparatus is at least 300 feet away, or has passed three city blocks. Another prohibits the approach or parking of any vehicle, except upon order of the chief, within a certain distance of a fire. Other cities require the police patrol with a squad of policemen or an emergency fire squad to respond to all alarms, establish fire lines, divert traffic and assist in removing automobiles parked near the fire.

Recommendations.

1. The elimination of the parking of all automobiles, except to take on or discharge passengers or freight, in all streets and alleys in congested districts is the only action a city can take which will effectively and permanently solve all of the problems herein presented. We believe that eventually this action will have to be taken by all cities. How soon such a regulation will have to be adopted by an individual city will depend upon local conditions, such as the lay-out and width of the streets, the density of traffic in its business district, the height of buildings and the rapidity with which motor traffic increases. Cities can gradually approach this permanent solution by providing for parking prohibitions during certain hours when congestion is the worst or in certain streets where traffic is the heaviest. Exception may be made to cars parked single file and parallel to the curb when attended by driver. We do not believe that time limits on parking in a street will help to solve any of the fire department problems.

2. When parking can or must be permitted, we recommend the following:

(*a*) Cars must be parked only in single file, parallel to the curb and at least five feet apart unless parking in the center of the street is possible.

(*b*) No parking within 20 feet of a hydrant, 25 feet of the crosswalk at a street intersection, 75 feet of a street intersection where a trolley car stops to take on or discharge passengers, 15 feet of the entrance of any place of public assemblage, and 25 feet, on both sides of the street, from any fire house.

(*c*) No parking in alleys, except for a limited time for actually loading or unloading.

(*d*) Prohibiting locking of gears and wheels of parked cars.

(*e*) Establishment of one way streets and requirement of parking on only one side of street when conditions are favorable.

3. To stop the practice of motorists chasing to and assembling near fires, all vehicles should be required to keep at least three blocks or 600 feet behind fire apparatus, and the same distance from a fire.

Fire Alarm Central Stations.

By W. J. Carroll.

A survey of the fire alarm offices of the country reveals a situation that is amazing from the standpoint of fire protection. These offices are recognized as the "nerve center" of the fire department. They are under the jurisdiction of the one city department that really appreciates the possibilities of fire, yet in city after city they are in most hazardous locations. Many, if not most of them, are seriously exposed. Lumber yards, woodworking establishments, frame buildings and exposures of a like nature surround them. The type of building often is such, that if a fire obtained a real start there would be little hope of saving the system. Internal hazards such as varnished wainscoating, oil storage, workrooms and similar conditions are found all too frequently.

In fairness to the fire chiefs and superintendents of fire alarm systems it must be said that the fire alarm offices remain in their present dangerous condition in spite of the most vigorous protests. The conditions have been inherited and those now in authority are not responsible for them. In many cities the internal hazards have been removed, but the hazards from the type of building and from the location can be eliminated in many cases only by moving the office to some spot carefully selected with a view to permitting uninterrupted service from this most important branch of the fire department.

Fires in Fire Alarm Offices.

The danger of losing the fire alarm office is real, not theoretical. More than two dozen cities of the country have had their fire alarm offices put out of service by fire in the past twenty years. Following is a list of some of these fires, which although obviously incomplete serves to call attention to the seriousness of the hazard. These fires are listed in the order of occurrence, the exact dates being given as far as these are known.

WALTHAM, MASS. 1900. Fire alarm headquarters was formerly located in the Moody Street Station. On October 8, 1900, the chief entered the building and found one of his call men there under the influence of liquor. He told the man that he would prefer charges against him. About midnight this man, after saturating the stalls with kerosene, set the building on fire for revenge. All the horses, with the exception of this man's team, were lost. The men sleeping in the building, barely escaping with their lives, pulled the apparatus out. The fire alarm equip-

ment was a total loss. A temporary headquarters was made in the old Spruce Street engine house by installing gravity batteries and looping all circuits in series. This was in operation about 4 P. M. the following afternoon.

BERKELEY, CAL. Fire alarm equipment installed in City Hall. Equipment and building were both destroyed by fire. A switchboard was borrowed from the manufacturers and service resumed without serious delay.

JACKSONVILLE, FLA. 1901. The fire alarm headquarters, a building of ordinary joisted brick construction, was destroyed in the conflagration of 1901.

PATERSON, N. J. 1902. The fire-resistive city hall building without window protection burned out in the conflagration of 1902. After some weeks of considerable interruption, the service was re-established with headquarters in the same location.

WATERBURY, CONN. 1903. The joisted brick headquarters building in path of the small conflagration of 1903 was completely destroyed. Headquarters are now in the fire-resistive city hall building.

BALTIMORE, MD. 1904. The conflagration destroyed the alarm headquarters

MARLBORO, MASS. About 1904. Fire alarm apparatus was located in City Hall, which was destroyed by fire. Temporary apparatus was borrowed from manufacturers and was working within twenty-four hours.

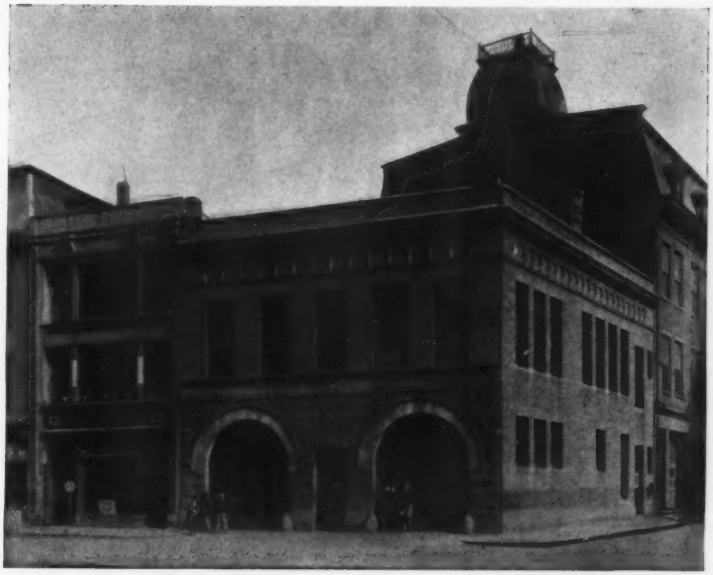
DULUTH, MINN. 1905. Crossed outside wires set fire to old wooden switchboard on the third floor of fire headquarters. The system was out of service until temporary connections were made.

SAN FRANCISCO, CAL. 1906. The alarm system was housed in an ordinary frame and joisted brick building in old city hall court yard, destroyed during the 1906 conflagration. The system was in temporary operation in two weeks. It required over six months to get back to normal conditions. The alarm central station is now located in fire-resistive, earthquake-proof building in a public park, remote from potential exposures.

SAN JOSE, CAL. The fire alarm office escaped in the earthquake of 1906 but at a later date the system was put out of service by a fire in the basement which burned off the cable carrying all the outside circuits.

BIDDEFORD, ME. 1907. Fire alarm apparatus was located in the city hall. Fire destroyed the building. Temporary system was in service within twenty-four hours.

PORTLAND, ME. 1908. Fire started in the apparatus room supposedly caused by a cross with high tension wires. The apparatus was in a joisted brick city hall building which was destroyed by the fire. The



The old Fall River, Mass., fire alarm headquarters were located on the second floor of the tall building in the background. The building is of inferior construction and severely exposed.

system was in service through temporary emergency connections before the fire was out. The alarm system remained in a temporary building until moved into a separate fire-resistive building in 1912.

CHELSEA, MASS. 1908. Conflagration destroyed alarm headquarters.

CHISHOLM, MINN. 1908. Conflagration destroyed alarm headquarters.

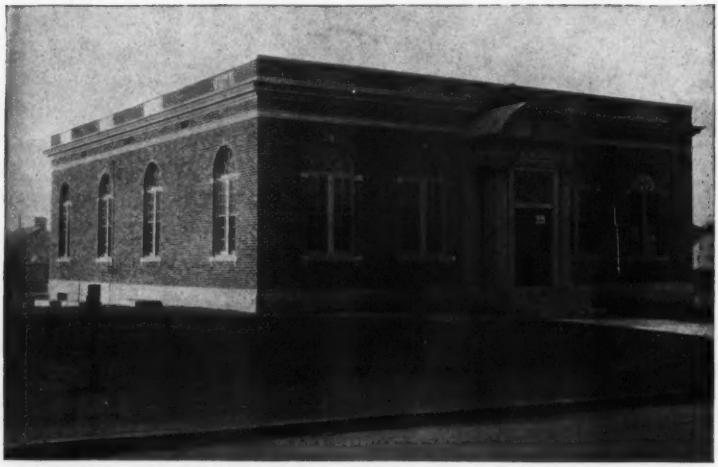
HOT SPRINGS, ARK. 1913. Conflagration destroyed alarm headquarters.

PARIS, TEXAS. 1916. Conflagration destroyed alarm headquarters.

NORFOLK, VA. 1919. Conflagration destroyed alarm headquarters.

MCKEESPORT, PA. On the evening of February 17, 1919, fire started in a garage in the combination police and fire department headquarters, which building housed the central station fire alarm equipment. Building was damaged by fire to the extent of from $3000 to $5000. Interior construction was highly combustible and without quick action the fire might readily have involved the entire building.

MCALESTER, OKLA. A two-story building of joisted brick construction with open stairways was used as city hall, and the headquarters of the fire department, fire alarm system, police department, jail and city officers. Fire was started by a prisoner at 2:45 A. M., November 29,



The new Fall River fire alarm headquarters is located in a park and is of fire-resistive construction.

1920. It was discovered by a person in a nearby dwelling, who notified the Fire Department by telephone. Fire spread into roof space and the entire building was destroyed. The fire alarm system was out of service about three weeks.

ALEXANDRIA, LA. Fire occurring at 1 P. M. on December 2, 1920, damaged the central fire station to the extent of several hundred dollars and put the fire alarm system out of commission. The fire was caused by a short circuit in the fire alarm switchboard room.

NORTH ADAMS, MASS. 1922. The fire alarm apparatus was located in the central police station. Fire destroyed the building and apparatus.

ASTORIA, ORE. 1922. Fire alarm apparatus was in a two-story frame building built on piling. Entire building and contents were destroyed in the conflagration of December 8, 1922.

SALAMANCA, N. Y. July, 1923. The office was located in a fire-resistive isolated building but was destroyed in a general conflagration which wiped out the entire business section.

NEWARK, N. J. All of the fire alarm boxes of Newark, N. J., some seven hundred, were put out of service by a $50,000 fire in the Newark City Hall on March 10, 1924. The fire broke out in the sub-cellar and melting the lead sheathing on the cables, caused short and cross circuits.

By working all night the fire alarm department succeeded in cutting in one hundred of the boxes by eight o'clock the next morning but it was one o'clock in the afternoon before the service was completely restored.

All of the firemen on the off platoon were called in and put out on patrol duty to watch for fires. Trolley cars were stopped and the passengers told that if the fire department were needed during the night that telephones should be used. Fortunately there were no serious fires during the night, only a few still alarms being received at headquarters.

This building was of the semi-fire-resistive, slow-burning type. It afforded much better protection to the fire alarm office than is provided in the majority of cities throughout the country, yet the system was out of service for eighteen hours and would have been out for a longer time if it had not been for the skilful work of the fire department and fire alarm bureau. The *Newark News* in commenting editorially on this fire said:

> The fire in the city hall Monday night although its havoc was confined to the basement and sub-basement floors for the most part, served to bring home to the city authorities one special lesson of large magnitude: This was that the fire alarm telegraph signal system of the Fire Department is perilously housed on the top floor of the city building.
>
> The fact that the wire connections of the fire alarm system, massed in the cables which form the direct and vital communications between the headquarters and the fire houses, was put entirely out of business by short and cross circuits and by the burning out of the cables proved the whole signal system to be at the mercy even of a not otherwise serious mishap.
>
> This fire alarm system ranks among the best and most complete in existence, notwithstanding it has been in service since soon after the present city hall was erected in 1906.
>
> The removal of the system to a building specially erected to house it and absolutely proof against fire or other mishap has been suggested. The fire alarm system is so vitally linked up with the safety of the city, with its property and with the very lives of its people, that the best protective measures to insure its uninterrupted functioning are imperatively necessary.
>
> The gravity with which the Fire Department considered the injury done to the system by this fire was plainly shown in the prompt formation of an emergency fire patrol which Chief Moore and his aids organized on the instant the true situation was discovered.

No attempt has been made to gather information regarding fires which seriously threatened but did not destroy the fire alarm office. The recent fire in Columbus, Ohio, focussed the attention of fire department officials, insurance engineers and a section of the press on this most important matter. Early in the morning on November 18 a fire broke out in a building adjoining fire department headquarters. The building was completely destroyed and for a time threatened to destroy the fire alarm headquarters. The following editorial from the *Philadelphia Bulletin* is typical of the interest which this fire stimulated in a number of newspapers whose editors appreciate the importance of safely housing the fire alarm office.

RUNNING A NEEDLESS RISK.

> The story of a fire in Columbus, Ohio, which came within five feet of the central switchboard of the city's fire alarm service, and by leaping that little distance might have crippled that part of the city's protection, has its warning for Philadelphia.
>
> The headquarters of Philadelphia's fire alarm service are on an upper floor of City Hall in a room which is surrounded by offices containing

inflammable material. It is by no means inconceivable that a fire should start within the City Hall building, in such proximity to these headquarters that the apparatus or its connections might be put out of commission.

Chief McLaughlin repeatedly has urged the necessity of a separate, fire-resistive building for this service as the only full measure of safety, but, even if that must be postponed, on the ground of necessary economy, the maximum of protection possible within the city building should be provided. An efficient fire alarm system is the first essential of fire fighting service.

The Danger of a Disabled System.

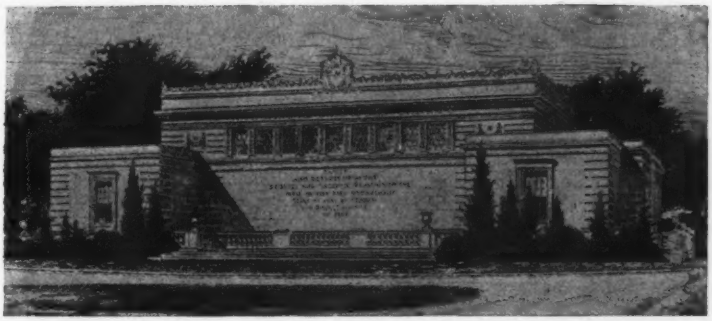
The extent of the hazard brought about by a disabled system can be truly appreciated only after careful study of the many ways that the fire alarm system affects the effectiveness of the fire department. The first result would be confusion at the street boxes. It would be a physical impossibility immediately to put notices on all of the fire alarm boxes in the city that they should not be used. A person who discovered a fire would go to the nearest box, operate it and then wait for the apparatus. There would be a loss of time and the non-arrival of the fire department would add confusion to a mind already sufficiently confused.

A second serious effect would be to throw the entire burden of fire alarm service on the telephone—a service for which the telephone is neither designed nor fitted. Mistakes and misunderstandings which are frequent now when the telephone is used would be substantially increased. Delays would occur in greater number. Strikes, fires in telephone offices or cable manholes and a host of other conditions may occur to put the entire telephone system out of service. If these two conditions occurred simultaneously, the city would be absolutely without means for rapidly calling the fire department. It may be claimed that such possibilities are remote, but many serious fires may be traced to equally remote possibilities which became actualities at an unfortunate time.

The fire alarm office in the large cities is not only a vehicle for the receipt of alarms but it is an important means for controlling the department by the Chief. The fire alarm office is the "Signal Corps" of the fire fighting army. Through it the Chief, while at a fire, keeps in touch with developments at headquarters. If reinforcements of a special nature are needed the fire alarm system is used to order them. If a serious fire occurs elsewhere the Chief through his aide is kept informed and if the second fire spreads the Chief may go himself.

The loss of the fire alarm office would be felt especially at times of simultaneous fires. The fire chief is fairly confident of his ability to prevent any single fires from developing into a conflagration. He views with considerable concern, however, the problem of serious simultaneous fires. Such occurrences are by no means as rare as might be imagined.

Boston recently had a three-alarm, a two-alarm and a single-alarm fire all within fifteen minutes. A few weeks previous three four-alarm



Plan of the new Boston fire alarm headquarters which will be located in the Fenway Park System. A building of this type combines beauty with efficiency and safety.

fires had broken out in the same city within two hours. During the same week Washington and San Francisco had two four-alarm fires within a few hours. During the month of January in Chicago there were three hundred and fourteen alarms in twenty-four hours followed by two hundred in the next twenty-four hours.

In St. Louis recently two large fires in the business district called out about forty engine companies and twelve hook and ladder companies. At times that night there were but seven engine companies left to protect an area of sixty-five square miles. These are the conditions which may develop into conflagrations and these are some of the reasons why the chief wishes to be as certain as is humanly possible that he will have the alarm system working when he needs it.

Fire alarm signals are sent to the apparatus houses from fire alarm headquarters over two circuits, the primary and secondary circuits. These two methods are provided to guard against any failure to receive signals. If the alarm headquarters is destroyed both of these means are cut off and the telephone, which is seldom, if ever, used for the assignment of companies, except for grass or chimney fires, is the sole means of notifying the various companies. Then, too, the telephone system may in some cases be put out of commission by the same fire that destroys the fire alarm headquarters.

The replacement of an office destroyed by fire is a serious problem. Fire alarm systems by their nature must be specially designed for the particular city if the best efficiency is to be secured. Conditions vary in different cities and it is not possible to obtain apparatus from stock. Usually from nine to fifteen months is required for the proper engineering and construction of an office for a large city. Smaller cities may secure apparatus in shorter time but at the best considerable time must elapse. As has been shown in the list of fires involving fire alarm apparatus, in

many cases alarm service is restored promptly by emergency measures, apparatus to replace destroyed equipment is given the right of way or used apparatus is loaned by the manufacturer. Such expedients, however, merely serve to reduce the duration of the dangerous period when the alarm system is out of service, and real safety can be secured only by placing the fire alarm central office in a proper location and in a building that will give adequate protection.

Educating the Public.

Worcester, Mass., is another city where the signal office has been exposed to disaster. The fire alarm office is located on the top floor of the fire headquarters building. This is an old building of a type of construction which should be condemned at sight for any such important service. It is located in a congested district with more than the usual hazards surrounding it. Twice fire has broken out on the floor where the fire alarm office is situated. In one case the flames attacked the wall of the room which housed the battery and if the fire had not been discovered the battery would have been put out of service within a few minutes and the entire system rendered useless.

Needless to say the chief of the fire department has strongly recommended that the office be put in a safe place and has publicly declared that he could not be held responsible for the safety of the system in its present location.

The methods which have been used by the chief and the superintendent of the fire alarm to bring this question to the attention of the public may well be followed in any city which is confronted by a like situation. The chief not only called attention to the need of safeguarding the system in his reports and public addresses but he made it a point to bring the members of the city government to the fire alarm headquarters so that they might see the hazards for themselves and see how nearly the fires had come to destroying the system. He enlisted the support of "Box 4 Association" which is composed of business men who are "fire fans." Slides were made which were shown in the moving picture houses. One slide showed the present location of the office in the hazardous district; another showed in contrast a modern office isolated and protected from the conflagration hazard. Other views showed the interior of the Worcester office and the interior of a recent modern office.

This educational work supplemented by the enthusiastic endorsement of the Box 4 Association soon began to make itself felt on public opinion. Some seventy executives of the leading industrial concerns in Worcester joined together and petitioned the city government to make provisions for a new fire alarm building and system. The newly elected mayor in his inaugural address endorsed the recommendations and the indications are

that Worcester will soon have its fire alarm system properly protected.

Choosing a Site.

Where the fire alarm building shall be located is important. Three main considerations will usually govern the location. The first is the location of the present cable center of the city. All other things being equal the office naturally should be located as near to the cable center as possible. This saves construction work, but more important, it permits the underground wires to be brought into the building from two, three and four directions instead of concentrating all of the wires in one manhole. If but one entrance is used an explosion or cable fire might put the entire system out of service. Usually this can be avoided if care is used in selecting the site.

The direction and character of the growth of a city should also receive careful consideration before the location is finally fixed. The studies of probable future population growth made by the telephone company and other public utilities will be of considerable value, as experience has shown that their forecasts have been remarkably accurate.

The relation of the office location to the conflagration zone demands the most careful study. It is possible today by utilizing the available surveys which have been made and the knowledge which is possessed by the fire protection authorities, to say definitely that there are certain sections of the city which should not be used because of the conflagration danger, and that there are other sections which are better than an average conflagration risk.

A public park or square is found usually to be the most desirable location and such locations have been used or are contemplated in a considerable number of cities, including the following:

FIRE ALARM OFFICES IN PARKS.

Los Angeles, Cal. (to be erected)
Oakland, Cal.
San Francisco, Cal.
Boston, Mass. (to be erected)
Fall River, Mass.
Kansas City, Mo.
New York, N. Y.
Manhattan
Brooklyn
Bronx
Richmond (planned)
Queens (planned)
Norfolk, Va.
Richmond, Va.
Roanoke, Va. (to be erected)

The design and construction of these offices have made them a striking addition to any park. There is no traffic to and from the office. There is only a very limited number of employees and when the subject is explained and the importance of the service pointed out there is no objection to the use of the small section of a public park which is required. When the question of a site for the new Boston fire alarm headquarters was being studied it was found that a park location was most

The Detroit fire alarm headquarters. A well-constructed isolated building.

desirable. To take any section of park land for such a purpose required a special act of the state legislature but when the need was properly explained the necessary permission was readily granted.

While parks usually afford the best sites, in many cases isolated buildings on other city property are sufficiently remote from fire exposures to afford proper safety for the fire alarm headquarters. The following cities have fire alarm offices in isolated buildings:

FIRE ALARM OFFICES IN ISOLATED BUILDINGS.

Fresno, Cal.	Milton, Mass.
New Britain, Conn.	Quincy, Mass.
New Haven, Conn.	Detroit, Mich.
Willimantic, Conn.	Atlantic City, N. J.
Albany, Ga.	Trenton, N. J.
Americus, Ga.	Albany, N. Y.
Augusta, Ga.	Binghamton, N. Y.
Evanston, Ill.	Kingston, N. Y.
Evansville, Ind.	Rensselaer, N. Y.
South Bend, Ind.	Schenectady, N. Y.
Wichita, Kan.	Troy, N. Y.
Alexandria, La.	Erie, Pa.
Bogalusa, La.	Providence, R. I.
Waterville, Me.	Galveston, Texas
Brockton, Mass.	Temple, Texas

Construction and Arrangement.

Offices of the best type are made as nearly fire-resistive as possible. Wired glass windows are preferred although usually the buildings are so well removed from the nearest building that there is little danger from

exposure. All interior combustible material is eliminated as far as possible. These buildings are either of one or two stories. When they are of two stories the battery and generator room together with the superintendent's office is put on the first floor and the apparatus room and dormitories are located on the second floor. Garage space is usually provided in the basement. This is cut off from the remainder of the building and entered only from the outside. In such cases it would be possible for the department truck to be destroyed completely by fire without affecting the building proper.

In some of the smaller cities one-story brick structures for alarm apparatus are built on the back of the lot with the central fire station. In such cases it is recommended that the building should be at least one hundred and fifty feet from the nearest building to guard against falling walls and radiation from a conflagration.

Fire alarm offices are also installed in fire-resistive buildings with other occupancies. The central fire station, a fire-resistive city hall or a building devoted to fire and police headquarters, are most commonly used. Some cities have taken a corner of a present brick, stone or concrete fire station and added on a fire-resistive structure cut off from the main building by fire doors. A list of cities which have their fire alarm offices in fire-resistive buildings follows:

FIRE ALARM OFFICES IN FIRE-RESISTIVE BUILDINGS.

Birmingham, Ala.
Berkeley, Cal.
Fort Wayne, Ind.
Terre Haute, Ind.
New Orleans, La.
Shreveport, La.
Baltimore, Md.
Malden, Mass.
Peabody, Mass.
Salem, Mass.
Waltham, Mass.
Clarksdale, Miss.
Manchester, N. H.
Ardmore, Okla.
Houston, Texas
San Antonio, Texas
Wichita Falls, Texas

The question of locating the fire alarm office in a fire-resistive building with other occupancies is one that deserves careful consideration. When it is located in a fire-resistive fire headquarters and operators are on duty at all times the office receives a high grade of protection and is ordinarily well guarded from interior hazards. It still remains exposed, however, to the conflagration hazard as the central fire station is properly located in the congested district. The experience with fire-resistive buildings in conflagrations indicates that even in such a building the fire alarm office would not be perfectly free from danger. The destruction of the interior of the Burlington Building in Chicago is familiar to all who have an interest in fire protection and this experience has been duplicated a sufficient number of times to make it obvious that wherever possible an isolated building should be erected.

The importance of fire-resistive buildings for fire alarm stations has long been recognized and in the report of every survey made by the National Board of Fire Underwriters of a city which has its fire alarm office in a hazardous location a recommendation along these lines will be found.

> That fire alarm headquarters be removed to a fire-resistive building with all exposed openings properly protected; all apparatus to be on incombustible mountings and no unnecessary combustibles permitted in the building.

The fire department officials in any city whose effectiveness is jeopardized by such conditions merit and should have the intelligent and active support of every one in that city who is interested in safeguarding life and property from fire. Based on past experience we can reasonably expect that a number of fire alarm offices which are now in hazardous locations will be destroyed by fire during the next few years. Such a loss inevitably results in an unnecessary increase in the fire loss with the possibility that such delays may be the cause of a widespread conflagration. Improvements will be made when the municipal officials who are charged with approving appropriations are convinced of their urgent need. The fire department officials will do their utmost to convince the city authorities but in this work they should have the help and co-operation of every citizen.

Fires from Tractor Exhausts.

In the January QUARTERLY (page 273) there were described two fires definitely attributed to hot soot or carbon discharged from the exhaust pipes of internal combustion engines. As a result of this report and the request for further information on this subject an interesting communication has been received from Member James L. Hubbard of Norwich, Connecticut, from which the following is quoted:

> A short time ago I was engaged in sawing wood with one of my tractors when dry leaves and grass became ignited from the exhaust. The fire was easily stamped out but led me to make a few experiments in this direction.
>
> The apparatus used consisted of one 30 HP International tractor, one 30 HP McCormick Deering tractor, one 8-16 HP International tractor, and one Fordson. Tests were made operating a belt drive, in motion pulling farming tools, and in motion without load. All the above machines exhaust into the air direct without mufflers.
>
> It was found that all the tractors acted in about the same way under similar conditions except that the location of the exhaust outlet on the Fordson changed the direction of the zone of danger and perhaps increased it somewhat.
>
> It was found that under certain conditions fires could be started as far as twenty feet from the tractor, that these conditions were likely to occur in practical operation, that kerosene fuel greatly increased the probability of trouble, that while keeping the machinery in proper condition reduced danger to a minimum, nevertheless a certain amount

of danger is always present. In my opinion it is safe to pass within six feet of buildings if the machinery is clean and in good order providing the tractor is kept in motion but it should not be operated on a belt within thirty feet of any building. These distances can be of course decreased if the side of the tractor from which the exhaust takes place is away from the building. With the Fordson no reduction should be made.

Danger of fire from direct action of the hot exhaust gases is not to be considered at distances greater than ten feet. Ninety-eight per cent of the trouble comes from flying particles of hot soot. This as stated above can not be entirely overcome even by frequent cleaning of the exhaust line and combustion chambers. While the danger of fire from this cause is about one per cent of the danger from sparks from the stack of a steam boiler of similar power, it nevertheless certainly exists.

As a result we have formulated the following rules for operation of our tractors. They are not allowed to enter buildings other than the tractor shed. They are operated only on gasoline while entering or leaving this shed and they are cleaned out internally and externally at frequent intervals.

Fire Losses in 1923.

The 1923 fire loss record figures for the United States and Canada, compiled from the daily records of the *New York Journal of Commerce*, reached a total of $389,192,200 as compared with $410,889,350 in 1922. This is the first year to show a reduction in losses over the previous year since 1919. The first six months of 1923 showed a continuation of the excessive fire losses of recent years, the figures being nearly $30,000,000 above those for the first half of 1922. The last few months of the year developed a decided change for the better and December showed a striking improvement, the loss being $22,000,000 less than in December, 1922.

The steadiness with which the high monthly fire loss record has been maintained is seen from the following table of the monthly loss record of the past three years:

	1921	1922	1923	1924
January	$35,319,950	$38,663,000	$36,614,850	$41,243,600
February	25,888,850	29,304,300	42,770,800	31,447,900
March	28,581,100	39,910,750	41,159,650	28,406,150
April	22,178,900	31,009,750	32,638,150	
May	23,956,800	29,868,950	34,015,850	
June	29,000,700	24,102,850	34,851,900	
July	33,355,750	36,667,750	27,490,750	
August	25,829,000	21,579,500	24,474,300	
September	26,502,400	41,515,000	28,738,500	
October	27,955,350	40,065,400	31,398,450	
November	26,178,600	30,776,100	29,702,200	
December	28,907,550	47,426,000	25,336,800	
Totals	$333,654,950	$410,889,350	$389,192,200	

The complete statistics of the Actuarial Bureau of the National Board of Fire Underwriters now published show a loss of $506,541,001 for 1922 as compared with $410,889,350 as given by the *Journal of Commerce* in

the estimates published early in 1923. Presumably the final figures for 1923 will have in the same approximate relation to these estimates, and on this basis the Actuarial Bureau's figures for 1923 may be expected to be slightly less than $500,000,000.

Forty-five Year Record.

During the past forty-five years the aggregate fire waste of the United States and Canada, as compiled from the *Journal of Commerce* records, has reached a total of $8,495,558,945. The record by years since 1879 is as follows:

1923	$389,192,200	1900	$163,362,250
1922	410,889,350	1899	136,773,200
1921	332,654,950	1898	119,655,500
1920	330,856,625	1897	110,319,650
1919	269,000,775	1896	115,655,500
1918	317,014,385	1895	129,835,700
1917	267,273,140	1894	128,246,400
1916	231,442,995	1893	156,445,875
1915	182,836,200	1892	151,516,000
1914	235,591,350	1891	143,764,000
1913	224,728,350	1890	108,893,700
1912	225,320,900	1889	123,046,800
1911	234,337,250	1888	110,885,600
1910	234,470,650	1887	120,283,000
1909	203,649,200	1886	104,924,700
1908	238,562,250	1885	102,818,700
1907	215,671,250	1884	110,108,600
1906	359,710,000	1883	110,149,000
1905	175,193,800	1882	84,505,000
1904	252,554,050	1881	81,280,000
1903	156,195,700	1880	74,643,400
1902	149,260,850	1879	77,703,700
1901	164,347,450		
Total, 45 years			$8,495,558,945

It will be noted that the past two years each show higher losses than any previous years, exceeding even the record in 1906, the year of the San Francisco conflagration.

Large Loss Fires.

There were an unusually large number of fires which caused a loss of $10,000 or more during the past year. The record shows 4,515 such fires as compared with 4,505 in 1922 and 4,068 in 1921. Thirty-nine fires which caused an estimated loss of a million dollars or over were recorded in 1923. As will be noted from the following table, California suffered from nine large fires during the year.

Month	Location	Description	Loss
January	Los Angeles, Cal.	Power Plant	$1,000,000
January	Los Angeles, Cal.	Wholesale Furniture	1,000,000
February	Syracuse, N. Y.	Business Block	1,200,000
February	South Omaha, Neb.	Packing Plant	2,000,000
February	East Mayfield, Tex.	Lumber Plant	1,000,000

Month	Location	Description	Loss
February	Gaviola, Cal.	Oil Refinery	$1,000,000
February	Hamilton, Ont.	Office Building	1,000,000
March	Montreal, Que.	Institution	1,000,000
March	Los Angeles, Cal.	Forest Fire	1,000,000
March	Philadelphia, Pa.	Paper Factory	1,500,000
March	Monett, Mo.	Railroad Shops	1,000,000
March	Merreaux, La.	Oil Refinery	1,000,000
April	Hot Springs, Ark.	Hotel	1,500,000
April	Budlington, N. J.	Stables	1,000,000
April	Burke, W. Va.	Business Section	1,000,000
April	Tottenville, N. Y.	Metal Refinery	1,000,000
May	Corsicana, Tex.	Oil Well	1,500,000
May	Hot Springs, Ark.	Business Houses	1,500,000
May	Fort Madison, Ia.	Bridge	1,000,000
June	Marquette, Mich.	Forest Fire	1,000,000
June	Philadelphia, Pa.	Railroad Station	1,300,000
June	Pittsburgh, Pa.	Oil Refinery	1,500,000
June	Fredericton, N. B.	Forest Fires	5,000,000
June	Corbyville, Ont.	Distillery	1,000,000
July	Burke Canyon, Idaho	Mining Town	1,500,000
July	Beaumont, Tex.	Oil Well	1,000,000
July	Stockton, Cal.	Hotel	1,000,000
August	Franconia, N. H.	Summer Hotel	1,000,000
August	San Pedro, Cal.	Oil Tanks	1,000,000
September	Berkeley, Cal.	Conflagration	6,000,000
October	Vernon, Cal.	Lumber Yards	1,000,000
October	Los Angeles, Cal.	Forest Fires	2,000,000
October	Jackson, Miss.	Lumber Plant	1,000,000
November	Nashville, Tenn.	Grain Elevator	1,000,000
November	Savannah, Ga.	Railway Shops	1,000,000
November	Reading, Pa.	Cordage Plant	1,000,000
November	Detroit, Mich.	Business Buildings	1,500,000
December	Charlotte, N. C.	Business District	1,000,000
December	New York, N. Y.	Shoe Factory	1,500,000

1923 Losses in Great Britain.

The loss record in Great Britain as compiled by *The London Times* showed a marked increase over previous years, the difference being largely attributable to the fact that in the 1923 figures individual losses under £1,000 are included for the first time. The loss is still relatively far below the losses in the United States and Canada. The following table shows the monthly fire loss record for the past three years:

	1921*	1922*	1923
January	£370,000	£1,285,000	£937,000
February	350,000	477,000	555,000
March	425,000	505,000	636,000
April	643,000	347,000	2,218,000
May	936,000	792,000	1,261,000
June	780,000	454,500	711,000
July	820,000	415,700	731,000
August	1,070,000	281,700	937,000
September	750,000	345,000	656,800
October	620,000	305,000	715,300
November	475,000	510,000	729,400
December	525,000	443,600	762,000
Totals	£7,764,000	£6,162,400	£10,849,500

*Figures for 1921 and 1922 are exclusive of losses under £1,000.

1923 Losses in Canada.

According to the separate statistics of fire losses in the Dominion of Canada which are compiled by *The Monetary Times*, the Canadian fire loss record for the year 1923 is decidedly more favorable than that for 1922, the sum total of the losses in 1923 being $34,277,550, against $44,206,405 for 1922. On the other hand, the totals for both 1920 and 1921 were substantially smaller than that for 1923, being respectively $27,706,574 and $29,987,510.

The following table gives the total amount of the Canadian fire losses in each month of the four years from 1920 to 1923, inclusive:

MONTH	1920	1921	1922	1923
January	$2,637,850	$2,237,900	$3,597,500	$2,156,150
February	1,895,575	2,735,000	4,062,400	4,520,200
March	1,793,200	2,112,200	4,331,750	4,429,050
April	3,229,500	2,510,700	2,532,100	2,380,500
May	2,001,819	3,811,350	2,956,450	3,214,400
June	1,424,319	2,303,400	2,162,550	3,125,400
July	1,426,850	2,880,250	3,652,000	2,048,900
August	1,857,800	3,014,860	1,926,355	3,100,500
September	2,480,485	2,410,300	3,127,000	2,530,300
October	2,467,901	2,199,700	5,627,950	2,816,100
November	2,769,800	1,818,750	2,954,400	1,990,800
December	3,721,475	1,952,600	6,815,950	1,962,950
Totals	$27,706,574	$29,987,510	$44,206,405	$34,277,550

The favorable showing of the last two months of the year have not been continued into 1924 as the loss for January is set at $3,983,975 and for February at $3,304,700.

$506,541,001 in 1922.

Final loss statistics for 1922, as compiled by the Actuarial Bureau of the National Board of Fire Underwriters (Member N. F. P. A.) show the total fire loss in the United States to be $506,541,001, the largest annual loss ever recorded. The loss in 1921 was $495,406,012, in 1917 was $289,535,050, and in 1912 was $206,438,900.

As indicated by the accompanying table, *Matches—Smoking* continues to be the chief cause of fires. *Defective Chimneys and Flues* is in second place superseding *Spontaneous Combustion* which has dropped to fourth place.

New York suffered the heaviest loss, its total being $57,854,369. Other states with large losses were Illinois ($26,692,705), Pennsylvania ($26,619,685), Texas ($19,896,616), and Massachusetts ($16,116,353).

NOTE: This data was published by the National Board of Fire Underwriters in *Safeguarding America Against Fire* for February, 1924. This publication is mailed regularly to N. F. P. A. members, but the data on fire losses is partially summarized herewith that it may be included in the permanent records of the N. F. P. A.

AMERICAN FIRE LOSSES COMPARED—1921-1922.

(Known Causes in Order of Importance)

CAUSES.	RECORDED LOSS. 1921	1922
Matches—Smoking	$25,992,033	$25,776,951
Defective Chimneys and Flues	14,801,581	18,550,433
Stoves, Furnaces, Boilers and Their Pipes	13,910,531	16,676,784
Spontaneous Combustion	20,186,392	14,594,799
Electricity	12,723,209	11,918,572
Sparks on Roofs	11,458,220	11,875,719
Lightning	12,353,222	11,513,725
Petroleum and Its Products	9,420,343	10,232,800
Sparks from Machinery	6,972,928	7,809,853
Miscellaneous Known Causes	7,705,196	5,115,583
Sparks from Combustion	4,864,771	4,825,101
Hot Ashes and Coals, Open Fires	4,327,268	4,069,690
Gas, Natural and Artificial	2,213,440	3,538,372
Explosions	1,980,274	2,797,953
Incendiarism	2,488,976	2,708,328
Open Lights	2,831,116	2,633,692
Ignition of Hot Grease, Oil, Tar, Wax, Asphalt, etc.	1,597,851	1,470,878
Rubbish and Litter	1,235,319	984,643
Fireworks, Firecrackers, etc.	573,595	775,203
Steam and Hot Water Pipes	191,771	187,296
*Exposure (including Conflagrations)	62,912,566	*61,917,414
Unknown Cause	175,584,208	185,259,010
Total	$396,324,810	$405,232,801
25 Per Cent to Cover Unreported Losses	99,081,202	101,308,200
Grand Total	$495,406,012	$506,541,001

*Losses due to spreading fires originating from various causes.

The Pekin Starch Dust Explosion.

By D. J. Price (Member N. F. P. A.),
Hylton R. Brown and Paul W. Edwards.
Bureau of Chemistry, U. S. Department of Agriculture.

One of the worst industrial plant dust explosions on record occurred about 3:35 A. M., January 3, 1924, in the Corn Products Refining Company's plant at Pekin, Ill. Forty-two men were killed or died in the hospital from burns received in the explosion, and twenty-two were injured. With one exception, this is the largest number of persons ever killed in an explosion of this character. In 1919 forty-three persons were killed as a result of a starch dust explosion in a factory in Cedar Rapids, Iowa.

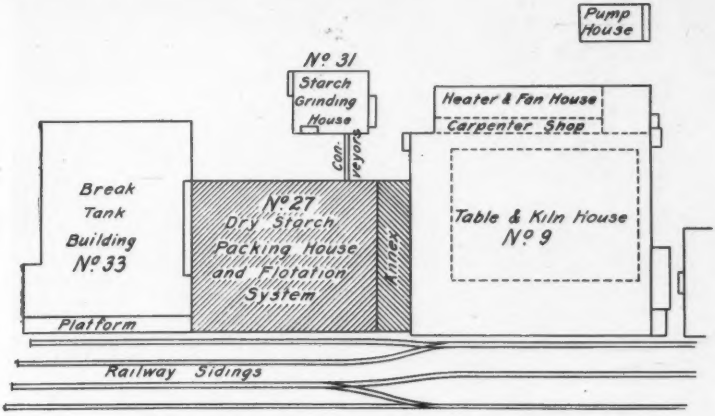
The damage done to the plant at Pekin by the explosion and fire which followed will probably amount to approximately $750,000, and $175,000 will probably cover the liability loss resulting from claims presented for the dead and injured.

Buildings Affected by the Explosion.

The plant consisted of a number of buildings designed for the manufacture of corn starch and by-products. The section of the plant affected by the explosion and fire consisted of five buildings known as the table house, annex, starch grinding house, starch packing house, and an adjoining building used at the time principally for storage. The plan shows the location of the various buildings referred to above. Practically all of the buildings were of fire-resistive construction, although a large part of the equipment in the various buildings was of wood or non-fire-resistive material. The older brick buildings had interior woodwork and wooden floors. The construction of the buildings affected by the explosion was of several types.

The table house, known as building No. 9, was a seven-story structure of brick, concrete and steel, approximately 135 feet wide and 290 feet long with concrete floors. A large part of the equipment was of wood, but on the upper floors of the building where the greater amount of wooden equipment was installed the nature of the starch tabling process in which large quantities of water are used was such that the fire hazard was considered quite slight.

The annex, which filled the space between the table house and the starch packing house, was of brick and steel construction, approximately 22 feet wide and 100 feet long. There was some wooden equipment in



Plan of the buildings involved in the explosion.

this building and an employees' locker room in the building might also be considered as slightly increasing the fire hazard. This building was equipped with automatic sprinklers.

The starch packing house, known as No. 27, which adjoined the annex on the south side, was a three-story brick building with steel framework, but it contained considerable woodwork in the form of storage bins, packing hoppers, and other equipment. It was approximately 100 feet wide and 125 feet long. Maple flooring was used on the first floor and half of the second floor. Sprinklers were installed in this building.

The break tank building, designated as No. 33, located directly south of the starch packing house and used principally at the time of the explosion for storage purposes, was of brick and steel construction, 100 feet wide and 130 feet long, but it also contained a large amount of interior woodwork and equipment constructed of non-fire-resistive material. This building was also provided with automatic sprinklers.

The starch grinding house, located west of the starch packing house, was a small two-story structure 40 feet wide and 50 feet long, of the "daylight" type, constructed of brick, steel and concrete with a tile roof and large window area. The floor in this building was of steel grating. The building was equipped with automatic sprinklers.

Manufacturing Processes in Damaged Buildings.

The nature of the manufacturing processes in the buildings affected by the explosion was such that the fire and explosion hazard was apparently limited to certain points where there was a possibility of the dry starch being thrown into suspension. On the upper six floors of the table house, known as building No. 9, the starch and gluten were separated by

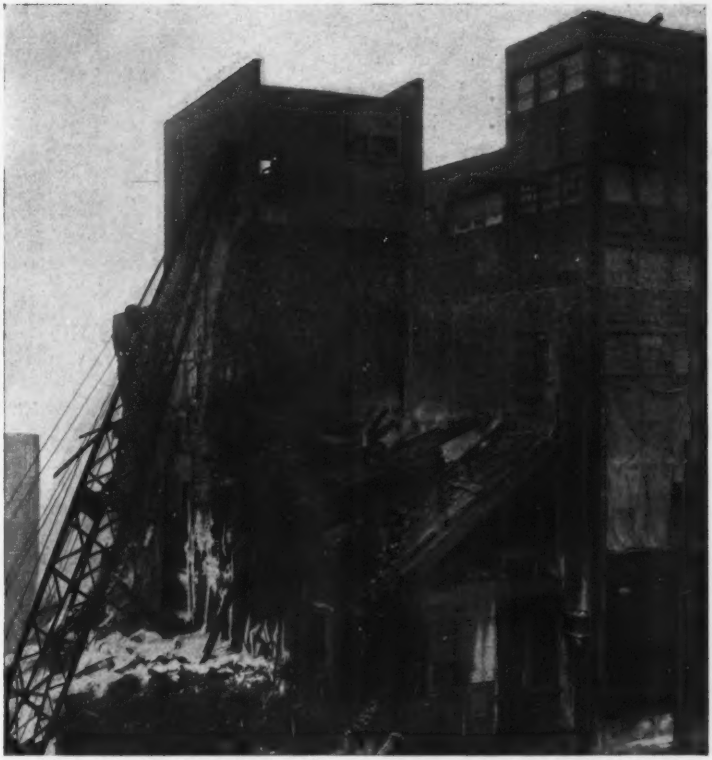
An overheated bearing ignited the wooden casing of this screw conveyor. The flames from the burning casing ignited a dust cloud formed when a load of starch was dumped into a hopper 15 feet distant.

running the mixture on to long tables or troughs. Because the starch is heavier than the gluten it settled out and remained on the tables while the gluten flowed off the end of the tables to be later recovered in settling tanks. The fire and explosion hazard at this point in the process would naturally be quite slight.

On the first floor of this building were located the kilns in which the wet starch removed from the tables on the floors above was dried to a moisture content of between 12 and 14 per cent. These kilns consisted of long tunnels on the floor of which was laid a narrow gauge railroad track. The wet starch was loaded into wire cages on wheels known as starch wagons or buggies and placed in the kilns to dry. There were sixty of these tunnels about 84 feet long, each of which had space for eleven wagons or buggies. Hot air passing through these tunnels or kilns carried off the excess moisture. When the moisture had been reduced to the desired percentage the wagons were removed from the kilns, placed on a transfer and carried to the tipples located at the southwest corner of the first floor of the building. At this point the starch was dumped from the wagons into conveyors, located in the basement, and carried into the adjoining building known as the annex. It was on the first or kiln floor and the southwest corner of the basement where the dry starch conveyors were installed that the greatest fire and explosion hazard in this building existed.

No special phase of the manufacturing process was conducted in the building known as the annex. It simply housed the necessary conveyors and elevators to transport the dry starch between the table house and the packing house.

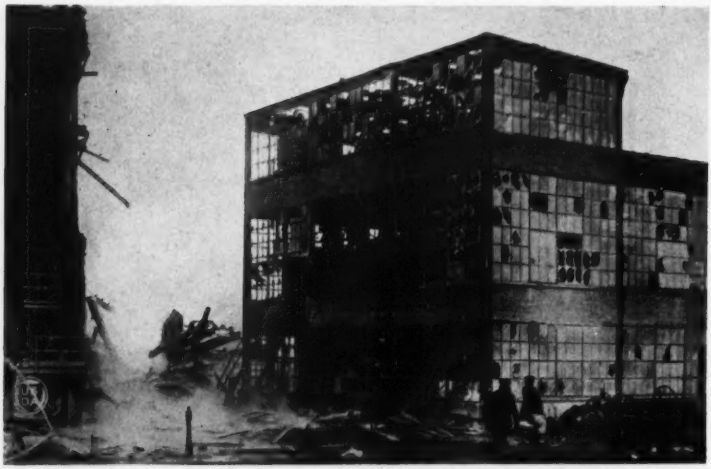
In the starch packing house, known as building No. 27, starch was packed into bags holding 100 to 140 pounds, although some of it was



The wreck of the annex building. The crane at the left of this picture is at work lifting wreckage to permit removal of the corpses of some of the 42 men who were killed. The explosion originated in the basement of the table and kiln house on the right, propagated through the annex and destroyed the starch packing house, the ruins of which appear on the left.

carried by conveyor to the starch grinding house (building No. 31) for further treatment. The packing process, which consisted simply of filling the bags from overhead storage hoppers, naturally created a considerable amount of dust and apparently the fire and explosion hazard in this section of the plant was fully realized by both the company officials and the employees.

In the starch grinding house the starch brought over from the starch packing house was pulverized in mills and bolted through silk clothed reels. It was then transferred back to the starch packing house through a screw conveyor to be packed for shipment in the same way that the pearl starch was handled. A considerable fire and explosion hazard existed in this section of the plant due to the possibility of foreign material entering



The value of "daylight construction." The structure of the starch grinding house was not seriously damaged although the explosion blew out most of the windows and some of the loss of life occurred in this building.

the pulverizers and the possibility of static electricity accumulating on the silk cloth of the reels. Precautions were taken, however, to reduce as far as possible this hazard.

Damage Caused by the Explosion.

The damage caused by the explosion, in addition to the life loss mentioned at the beginning of this article, consisted of the total destruction of the starch packing house; the destruction of the east and west walls and the southeast corner of the annex; the blowing out of many windows and the destruction of tile walls in the table and kiln house; and the destruction of the roof and windows of the starch grinding house. The damage to building No. 33 located south of the starch packing house was caused principally by the fire which followed the explosion. The photographs which accompany this article show the extent of the damage.

Origin and Cause of the Explosion.

Engineers of the Bureau of Chemistry of the United States Department of Agriculture, who have been studying the dust explosion problem for a number of years, made a thorough investigation of this explosion in conjunction with John G. Gamber, State Fire Marshal of Illinois. After a thorough examination of the affected section of the plant and the consideration of all evidence collected, many of the suggested causes were eliminated. A study of the path of propagation of the explosion indicated that the explosion had originated in the southwest corner of the basement of the table and kiln house. The tipples which dumped the starch from the wagons were located in this corner of the building on the first

floor. An examination of these tipples and the conveyors beneath them indicated that the explosion was caused by a fire in one of the screw conveyors carrying starch from the tipples. The fire was apparently caused by an overheated bearing in the conveyor about 15 feet from the tipple and this fire ignited the dust cloud formed when a wagon of starch was dumped in the tipple hopper. This initial explosion propagated back through the tipple to the first floor and spread around the kilns and loading hoppers. In the basement this initial explosion blew down a tile wall near the conveyor and another light tile wall which formed part of an air duct under the kilns. The flames propagated up through the kilns, blew off the doors on the east side of the kilns and then traveled south through the annex to the starch packing house where the second and more violent explosion occured. From the first floor of the table and kiln house the flames also propagated to the upper floors of the building, but the presence of only a small quantity of dust on these floors prevented the building up of any great pressure. It is believed that the damage to the starch grinding house was caused by the explosions in the starch packing house and the table and kiln house, as there was very little evidence of extensive flame propagation through this building. One of the photographs shows clearly the condition of the conveyor box as found at the time the investigation was made. The flames from this burning box were evidently the cause of the dust ignition.

Lessons Learned from the Explosion.

The three most important lessons learned from an investigation of this explosion are: the value of the daylight type of building, the necessity of adopting a positive form of lubrication at points where the fire or explosion hazard is present, and the desirability of isolating buildings in which such hazards exist.

If there had not been large window areas in buildings No. 9 and No. 31, the damage in both buildings would undoubtedly have been much greater. The failure of the roof on building No. 31 also helped in reducing the pressure in this unit and prevented greater damage to the interior and the equipment installed.

An alarm system for indicating hot bearings or a positive system of lubrication is desirable on all equipment where the material being handled is flammable. Such systems are especially necessary on bearings located in places which are not readily accessible.

It has been shown that the isolation of buildings in which the fire or explosion hazard exists often limits the explosion and fire to the unit in which it started. It is, therefore, recommended that in industrial plants where dust explosions are liable to occur all buildings be isolated sufficiently to prevent the spreading of a fire or an explosion from one to the others.

The Pipeless Furnace.

The pipeless or one-pipe furnace has recently become a popular form of heating device which is being widely installed, especially in dwellings and small stores. While the hazard of the one-pipe furnace is for most purposes the same as the hazard of the ordinary hot air furnace there are certain differences in construction and arrangement which may tend to increase the hazard under certain conditions, and it is evident that a furnace of this type must be designed, installed and operated with consideration of the possible fire hazards involved. As far as is known the fire record of the pipeless furnace is in general reasonably satisfactory, but the reports of the fires which follow show the kind of trouble which may be expected when the pipeless furnace is not properly installed and operated.

The construction of the device is in some respects similar to that of the ordinary hot air furnace. The main fire chamber, however, is surrounded by two casings, the inner casing leading directly to the center circular part of the register immediately above the furnace, and the outer casing to the outer square part of the register. Cold air is drawn from the floor above through the outer portion of the register into the space between the inner and outer casings, then over the heated portion of the furnace and up through the central section of the register.

The fact that the pipeless furnace provides for direct recirculation of air renders it unsuitable for use in occupancies where there may be flammable vapors or dusty atmospheres, such as in garages, woodworking establishments and the like. This limitation seems to be fairly well recognized, and in the record which follows no fires are reported as being due to installation of pipeless furnaces in garages or other such properties for which they are not suited.

The primary difference between the pipeless and the ordinary systems of hot air heating is that with the pipeless furnace the discharge of hot air is concentrated in one central register directly above the furnace instead of being distributed through a number of smaller pipes. Much higher temperatures are thus developed, and it is a fundamental rule of installation and operation that combustible materials should not be located directly above or close to the hot air discharge section of the register. Cotton clothing or similar combustible material may be ignited in a comparatively short time when placed on the register, as has been shown by

several fires. One type of installation, where the central register is placed directly under a partition with openings into rooms on both sides, seems to be especially hazardous in that the woodwork of the lower part of the partition can easily become overheated and ignite. In the record which follows only one fire is reported as due to such an installation, but it would seem that many more fires may be expected in connection with arrangements of this kind should they come into very general use.

Another limitation of the pipeless furnace is that in order to secure proper heating efficiency it must be placed only in the hallway near the stairs, or in some other central location, of a building which has free and open communication between all floors. In one case reported the pipeless furnace register was located in a very small hallway, all the doors to which were closed at night. In this case apparently the air in the entire hallway became overheated, with the result that woodwork was ignited.

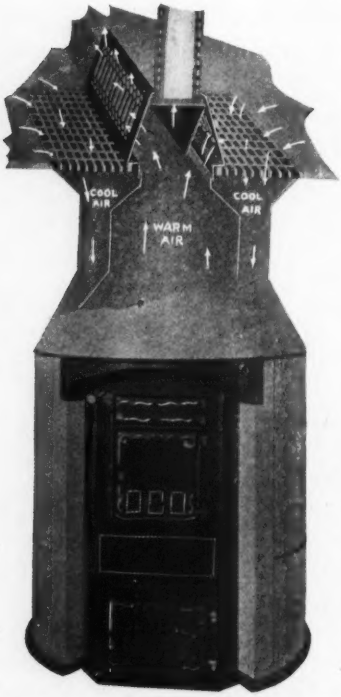
The necessity of placing pipeless furnaces in certain definite parts of a building in a central location near a stairway sometimes in existing structures necessitates unduly long runs of smoke pipe to reach chimneys which may be at remote corners of the house. One fire caused where such a long smoke pipe passed through a wooden basement partition is included in this record on the ground that a heating device of some other type would have been installed nearer the chimney without such a long run of smoke pipe. This is the only case included where fire was caused by the smoke pipe. Other cases of fires due to defective installation, chimneys, and flues have not been included in this record on the ground that the fire would have occurred in such cases with any type of heating device.

This record, including only fires which have occurred during the past few months, is indicative of the type of fire which is directly traceable to the pipeless furnace. While the information on these fires is in many cases incomplete, it is felt that a summary of the available data will be of interest. It is not the thought in presenting this to draw comparisons between the pipeless furnace and other types of heating device, but merely to indicate the hazards which may be expected where pipeless furnaces are not properly designed, installed and operated.

Two Fires at Saugus, Mass.

Two fires which occurred at Saugus, Mass., early in February were investigated by one of the N. F. P. A. executive office staff. The first fire occurred in a small frame farm dwelling. The register, approximately three feet square, was in the hallway. This hallway was very narrow and wooden lath and plaster partitions were within six inches of the register on both sides. All the hall doors were closed at the time of the fire and there was a brisk wood fire in the furnace. The heat in this closed space became intense and finally the partitions ignited. The owner

of the house stated that there was no combustible material in the hall or on the register. The fire was extinguished by the fire department with chemicals. The loss was about $1,000.



Type of pipeless furnace installation which caused a fire in Charlottetown, P. E. I. The wooden partition ignited from the heat of the furnace.

The second fire occurred in a small frame dwelling house. Some clothes were drying on a rack placed directly over the furnace register. It was about eight o'clock in the morning and the fire had been started with wood. According to the boy, aged 12, who was in the house at the time of the fire, the furnace fire was not unusually hot. He stated that at times he could look down the register and the iron below would be red hot but that it was not hot enough for this condition at the time of the fire. The clothes ignited and the boy and his mother tried to drag the blazing clothes rack out through the door, but it caught on the threshold. A baby was sitting in a high chair close to the clothes rack. The fire gained headway so quickly that the mother and boy were unable to rescue the baby. Both had to jump from windows after being badly burned. Within a few minutes the house was burned to the ground. The baby was burned to death.

The cellar space underneath the house was only about seven feet high. The furnace pot was presumably not more than five feet below the floor. The register was approximately 2½ feet square.

Charlottetown, P. E. I.

In some cases these furnaces are installed so that the register is divided by a partition and two rooms of the house receive direct heat. (See illustration.) This method is obviously potentially hazardous. One fire caused by such an installation is reported by E. H. Beer (Member N. F. P. A.). The fire occurred in February in a church in Charlottetown, P. E. I. The furnace was used to heat some of the social rooms of

the church. The partition ignited from the heat but fortunately the fire occurred about noon and it was quickly discovered and extinguished. This fire was without question due to the heat from the furnace igniting the partition. There was no defect in the installation and asbestos insulation had been used in accordance with instructions given by the furnace manufacturers.

Three Fires in Nova Scotia

Three fires have been reported by Major J. A. Rudland (Member N. F. P. A.), fire marshal of Nova Scotia.

1. This fire occurred on January 6, 1924, at Windsor, N. S., in a three-story brick building. A store on the first floor was heated by a pipeless furnace. Wood had been used for fuel up to the evening before the fire, when some hard coal was used.. The proprietor attended to the furnace about 10 P. M. and left the store. The fire was discovered at about 4 A. M. the next morning when flames broke out of the second story.

Upon investigation after the fire was out, the origin of the fire was found to have been at the point where the piping passed through the floor from the basement to the register above. The fire had started beside the piping immediately above the furnace door and burned along under the floor. The ceiling in the basement was low. The piping at this point was for cold air and should have been cool.

2. This fire destroyed a theatre at North Sydney, N. S., on February 9, 1924. The pipeless furnace was installed in December, 1923. The smoke pipe at the rear of the furnace led at an angle of 60 degrees for about 3½ feet to within a foot of the floor beams where it was protected by metal guards and the ceiling was protected by a metal guard. There was an air space of about an inch between the pipe and the guard. The pipe then passed through a partition between the furnace room and a basement dressing room. There was an air space of about six inches around the pipe where it passed through the partition. The wood was protected with tin at the edges of this opening. The pipe then passed diagonally through two dressing rooms to the chimney. It was separated by a 10-inch clear space from the walls of these rooms. There was one register about 30 inches in diameter in the main hall.

The fire occurred about 8 A. M. The janitor had stoked the fire about ten minutes previously and was in the theatre above when he noticed smoke. Just as he reached the basement flame broke out in the wooden partition through which the smoke pipe passed. The walls and ceiling of the theatre were lined with plasterboard. The fire spread very rapidly and the building was completely destroyed. The fire was evidently due to the heating apparatus but the exact cause could not be determined because of the destruction of the building.

3. This fire occurred in a dry goods store at Halifax, N. S., on February 16, 1924. The register of the pipeless furnace was located in the rear of the store. There were racks consisting of metal bars six to seven feet from the floor and about 40 inches from the register on which were hanging dress goods, such as muslins and cretonnes. The proprietor and a friend were in the store about 11 P. M. and were closing up for the night. About 15 minutes previously the proprietor had stoked the furnace with six to eight shovels full of anthracite coal. The racks of cloth caught fire and the fire spread so rapidly that the store was practically destroyed, although the proprietor immediately gave the alarm and the fire department responded promptly.

The exact cause of the fire was not determined but it seems probable that heat from the furnace ignited the cloth. Two days later an inspector found the furnace in good condition with the fire still burning in the fire pot. There was no evidence of fire in the basement except in one spot where the fire had burned through from the floor above.

St. Paul.

A pipeless furnace fire that occurred in St. Paul, Minnesota, on December 31, 1923, is reported by John Townsend, Jr. (Member N. F. P. A.). The fire occurred in a one-story brick joisted building used for the storage of paper. There was a large pipeless furnace in the basement and the fire pot had apparently become red hot at the time of the fire. A truck load of paper had been left over the register at closing time (probably five o'clock) and at 6:28 P. M. the fire was discovered. The fire spread through the paper stock very rapidly causing a loss of approximately $11,000.

The Civic Sentinels.

"Keep New Haven Clean and Safe" is the slogan of the Civic Sentinels, an organization sponsored by the New Haven Chamber of Commerce, and composed of boys and girls from the civics classes of the New Haven Commercial High School. The members of this organization keep up a continual inspection of streets, report fire and accident hazards and violations of city ordinances relating to cleanliness and safety.

The organization was founded early in 1923, and is under the direction of the Civic Sentinels Committee of the Chamber of Commerce. This committee receives the hearty co-operation of teachers, club teachers and city officials in its work.

Boys and girls who enlist as Civic Sentinels are required to sign the following pledge:

I hereby pledge myself to become a "Civic Sentinel" of the New Haven Chamber of Commerce, and to mail a report at the end of each month regarding the condition of the streets assigned to me. I will refrain from throwing waste material of every nature upon the side-walks, streets, avenues, parks, and other public places and will call attention of offenders to the laws against throwing or sweeping rubbish upon the streets and highways, and to other laws relating to cleanliness and safety.

Civic Sentinels receive proper credentials from the Chamber of Commerce, including a commission signed by the President of the Chamber and the Chairman of the Civic Sentinels Committee, and an appointment card and badge to show to violators of city ordinances. They are instructed in all ordinances relating to cleanliness and safety, as well as in general rules of fire prevention and sanitation.

The monthly reports sent in by Civic Sentinels are graded, and these grades reported to the teachers for credit in civics classes.

Violations reported to the Chamber of Commerce are called to the attention of the proper city official for correction, but the Sentinels are instructed to attempt to obtain a correction from the violator by speaking to him before reporting the violation. This has worked out very satisfactorily, the Sentinels having developed a genius for diplomatic handling of violators.

During October, 1923, the Sentinels reported that they had succeeded in having violations of ordinances corrected in 125 cases, while 42 violations which the Sentinels could not have corrected were reported to city officials.

The advantages resulting from the Civic Sentinel activities are fourfold:

1. The children are educated in the rules of cleanliness and safety.
2. The children educate the elders.
3. Violations which would not be discovered by regular city inspectors are corrected or reported.
4. Money is saved the city and property owners by saving on pavement repairs, protection of private property, prevention of flooding of catch basins and sewers, keeping fire alarms in good condition, reporting dangerous fire and sanitary conditions, preventing damage to fire hydrants and street lights, preventing accidents and playing in the streets.

Lynn English High School Fire.

Report by H. L. Farnham and P. E. Usher.
(Members N. F. P. A.)

Fire which started from an unknown cause, in the basement of the English High School at Lynn, Mass., shortly after midnight on March 29, 1924, totally destroyed the main or original building of the group, with a property loss estimated at about $750,000, and caused the death of one fireman and the injury of several others before it was extinguished.

A large addition to the main building was saved by a substandard fire wall with door openings protected by fire doors. In this addition, however, there occurred a serious hot air explosion which caused considerable damage to the plaster sheathing in the top floor and dislodged part of the cornice on the side wall, the falling bricks from this cornice being the cause of the death and injury to firemen.

During the height of the fire, a heavy rain storm occurred which undoubtedly prevented a conflagration in the center of the city, as brands from the fire were spread over a large area of mercantile and dwelling houses where shingle roofs predominate.

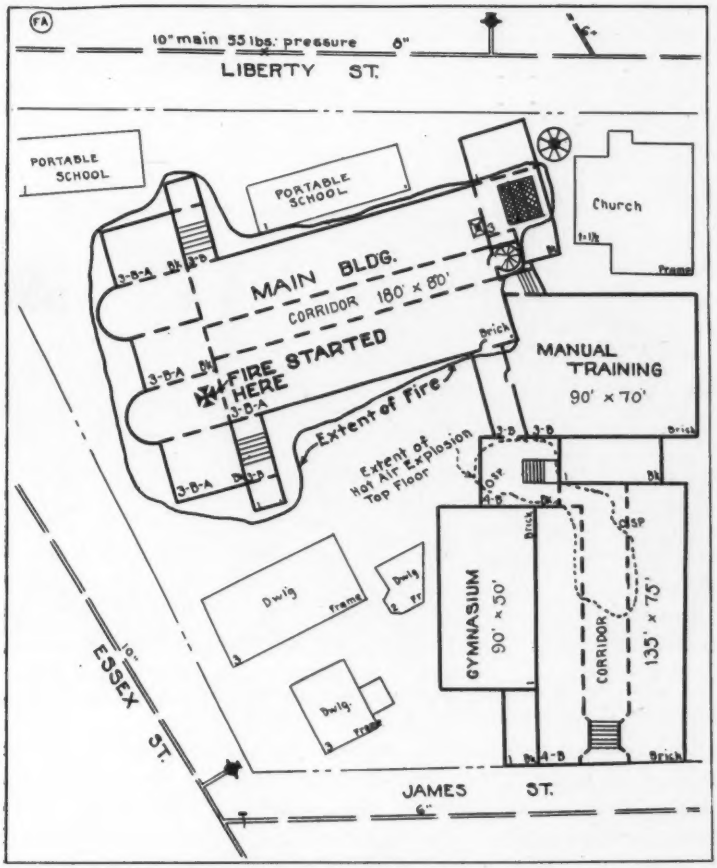
Construction.

The main building was erected in 1892. Several additions have been added to this original school from time to time, the largest being the James Street Addition, built in 1916.

The main building covered an area of about 18,000 sq. ft. Walls were of substantial brick construction with back plastering and wooden wainscoting, forming hollow spaces. Floors were of plank on timber construction with wooden lath and plaster sheathing between the floor beams. The roof was plank on wooden trusses, high pitched, slate covered, and formed a large inaccessible open attic extending over the entire building. The floor of this attic was wooden lath and plaster, suspended from the bottom of the trusses.

The main building was in the form of a large "T," the front section consisting of three stories, basement and attic, and the rear section four stories, basement and attic. A long corridor extended through the central portion of the building with brick partition walls up to the third floor. The class rooms were located on both sides of this corridor, with partition walls between rooms of wood frame and plaster construction.

At both ends of the front section were large open iron stairways from



Plan of the Lynn English High School. Substandard fire doors in the passageway between the main building and the James Street Addition permitted a hot air explosion as indicated.

first to third floor. The stairs from basement to first floor were of wood. At the southerly end of the rear section were two stairways enclosed in brick towers with door openings protected with indifferent fire doors.

Numerous metal ventilating flues, located mainly in the partition walls between class rooms, undoubtedly aided in the rapid spread of fire.

The heating plant was located in a small one- and three-story addition, adjoining the southerly end of the main building. The two upper floors, used for chemical laboratory and storage, were destroyed. The boiler plant was not damaged.

The Lynn, Mass., English High School which was destroyed by fire on March 29, 1924. Thousands of schools of this type of construction may be found throughout the United States and Canada.

The manual training wing, adjoined the southwest end of the main building. A passage across the northerly end of this wing connected the main building with the Addition. A stair tower at the southerly end of the main building also formed a means of communication between the main building and the manual training wing. There was an attempt made to provide a cut off between the main building and the additions by installation of substandard fire doors at the passage and the stairway.

The manual training wing was three stories and basement, brick walls with open joisted floors and roof. The addition was four stories and basement, brick walls with hollow joisted floors and roof, with an inaccessible concealed space under the roof. Stairways were open with poor, swinging wired glass doors at corridor entrances.

Although these additions were of later construction than the original building, the type of construction was decidedly inferior, and had fire gained access to these buildings, their destruction would have been even more rapid than that of the main building.

Protection.

The water mains in the vicinity of this school are of exceptionally large size and well gridironed, consisting of 8-in. and 10-in. mains, supplied by a 30-in. force main one block distant.

The supply of hydrants in the immediate vicinity of the school proved ample.

In addition to the six pumps and tractor drawn steamers in this city, there were nine pumping engines sent from neighboring cities and towns. This assistance proved of immeasurable value. Without it, the local fire department could hardly have confined the fire to the main building.

For inside protection, the main building and additions had an equipment of chemical extinguishers which were not a factor. There were also three small standpipes in the James Street Addition, hose from which was used throughout the fire, particularly on the fire doors at the passage to the main building. Undoubtedly these streams helped to keep the fire out of this building.

Story of the Fire.

Although an inquest has been held by the State Police, the cause of the fire will probably remain unknown. Spontaneous ignition in the rubbish and waste paper found in the waste paper baling room is a likely cause.

Shortly before the fire was discovered, a policeman entered the building. He claims he was in the building for a few moments only and when about to leave, discovered the front end of the building full of smoke. A fire alarm box is located inside the entrance near where this policeman had to pass to reach the outside. He was unable to find it, due to the heavy smoke, and turned in the alarm from a public box, located across the street.

When the fire department arrived, they found the basement a roaring furnace and a second alarm was immediately sounded, followed a few minutes later by a general alarm. As the flames gathered headway, the chief realized that additional help would be needed to prevent a general conflagration and help was summoned from neighboring cities and towns.

From available evidence, the fire started in the waste paper baling room in the basement, located just at the right of the entrance to the building. The fire extended from here through the numerous open spaces back of the partitions, directly into the large open attic; also to the main corridor in the basement where it spread unobstructed up the large open stairways to all parts of the front section, and into the rear portion.

First streams were concentrated at the front end where the fire was apparently the hottest, but undoubtedly the fire at this time had gained headway in the large open attic which was inaccessible to hose streams.

Vertical openings were responsible for the rapid spread of this fire. Fifteen pumping engines backed up by plenty of water were unable to prevent the total destruction of the main building.

The fire, confined by the slate roof covering, gained great headway here. In a short period, the slates began to loosen and fall, several firemen being injured by these falling slates, this causing a retreat by the hosemen from their advantageous positions, making it necessary to fight the fire from a considerable distance. Soon after, the roof collapsed, carrying portions of the floors below with it.

As the fire spread through the rear section of the main building, threatening the manual training wing and James Street Addition, strength of the fire department was massed at this point, streams being used both inside and outside of these additions and with the assistance of the fire doors, the fire was successfully checked here.

The above mentioned fire doors are of the double swinging type with no provision for holding them closed. Hot air and smoke passed through these doors into the top floor of the James Street Addition in sufficient quantity to cause a hot air explosion which ruptured the corridor walls of part brick and part gypsum block and the wired lath and plaster ceilings in the vicinity of the main stairway. This explosion also caused the north wall of the stair tower to bulge, loosening the cornice and coping, part of the latter of which fell, causing the death of one fireman and the injury of several more.

During the height of the fire there were 30 hose streams being used

and although these streams were of good calibre, it was readily apparent that they lacked the volume and force necessary to reach the heart of the fire, breaking and turning to steam shortly after entering the windows. The effect of the lone wagon gun stream, located near the south end of the rear section, main building, was apparent. This stream was undoubtedly a factor in preventing the fire from spreading to a frame church close by.

The destruction of the main building was practically complete. The damage caused by the hot air explosion in the James Street Addition was not serious. The manual training wing escaped damage.

Lessons of the Fire.

The principal factor in the total destruction of this large school may be attributed to vertical openings in the nature of large open stairways, large hollow spaces back of wall sheathing connecting the basement with the large open attic and a network of metal ventilating ducts.

The installation of an automatic sprinkler system, at least in the basement of this building, provided openings into the first floor were properly protected, would undoubtedly have prevented this serious loss.

While it is a fact that the substandard double swinging fire doors were a factor in checking the spread of fire into the additions, it is to be noted that it was through these doors that the hot air and smoke entered the James Street Addition, resulting in the hot air explosion. Standard double fire doors at this important cutoff would undoubtedly have prevented this explosion and not have required the support of hose streams at this point.

This fire again emphasizes the need of more adequate attention to the construction details and fire prevention equipment in schoolhouse properties where many lives are endangered and property values are relatively heavy.

Many schools, considered "fireproof" by the local school authorities because of brick or other incombustible wall construction, offer no more protection against fire than this school. It is significant that the spread of this fire was checked with difficulty in spite of the fact that Lynn has a modern city fire department which was reenforced by aid from several neighboring towns and by a severe rain storm. Schools of this type and size in smaller towns with less adequate fire fighting forces form a serious conflagration menace.

Some Factors in Sprinkler Efficiency.

By W. D. Milne
(Member N. F. P. A.)

The N. F. P. A. Annual Sprinkler Tables (page 401) show very clearly the factors which lead to the few cases of failure of sprinklers to properly control fires. The records do not, however, attempt to show what conditions lead to the opening of more sprinklers in one fire than in another. It is sometimes of interest to check up on opinions formed as to the conditions which tend to make the work of automatic sprinklers inefficient, by means of tabulations from the fire records.

The tabulations appearing below were made after an assumption that if five or more sprinklers operated in a fire, there was present some condition unfavorable to the action of the sprinkler protection. Fire reports as received by the Association were reviewed as they came in until a total of 223 reports were available showing in each case the operation of five or more sprinkler heads in fires starting in sprinklered areas while the sprinkler system was in service. It should be borne in mind that the number of reports involved is too small to serve as the basis of general averages, and that in a number of cases two or more factors will lead to the opening of five or more sprinklers. An effort was made to distinguish and list the principal unfavorable condition in each case.

The 223 reports examined covered fires in the following general classes of occupancy:

FIBRES, total 94. (Cotton Mills 53, Cotton Waste Mills 7, Bleach and Dye Works 1, Mattress Factories 4, Woolen Mills 18, Knitting Mills 3, Flax and Jute Mills 2, Cordage Works 4, Silk Mills 2.)

PAPER, total 25. (Pulp and Paper Mills 19, Paper Coating 3, Waste Paper Storage and Sorting 3.)

WOOD, total 22. (Various woodworkers 22.)

METAL, total 19. (Various metal workers 19.)

LEATHER, total 4. (Tanneries 1, Shoe Shops 3.)

CHEMICAL, total 11. (Celluloid 3, Paint and Varnish 5, Chemical 3.)

MERCANTILES, 4.

CLOTHING MANUFACTURE 16.

RUBBER MILLS 4.

PRINTING AND ENGRAVING 4.

MISCELLANEOUS 20 (including linoleum works, meat packers, rag

shops, cereal mills, paint shops, candy factories, cork works, stables, tobacco factories, garages, etc.).

"Flash fires" of course tend to open large numbers of sprinklers. Hazards of this nature were found to be predominating in fires tabulated as follows:

(*a*) MACHINE PROCESSES ON FIBRES, total 61, divided as follows:
Cotton pickers 15, openers 9, bale breakers 2.
Cotton waste pickers 8, garnetts 2, willows 1, mattress 3.
Woolen mill pickers 4, garnetts 2, cards 3, mixing pickers 2.
Jute cutters and pickers 3, flax 1, silk shoddy 1, hemp 2.
Gauze rooms 1, picker bins 1, dust rooms 1, nappers 1.

(*b*) FLAMMABLE SOLIDS, LIQUIDS, VOLATILES AND GASES gave a total of 28 fires as follows:
Liquids, total 23—
Dip tanks of japan 4, benzine 2, benzol 1, rubber cement 1, lacquer 1, paint 1, asphalt 1 (11).
Varnish mixers 2, churns 1, asphalt kettles 1, fuel oil burning 3, paint remover 1, benzol in chemical treatment 2, ink (rotogravure) 2 (12).
Solids, total 3—
Celluloid 2, chlorate of potash 1.
Gases, total 2—
Hydrogen 1, gas 1.

(*c*) DUSTS, total 16—
Sawdust at boilers and shavings vaults 6, in mill rooms 3, pulp mill barkers and grinders 2, chip lofts 2, excelsior mills 1, cereal dusts 2.

(*d*) FLAMMABLE STOCKS not exposed to machine process hazards, but usually in storage areas, where the nature of the material was the controlling factor rather than the manner and depth of piling, total 16—
Cotton 5, cotton waste 2, rags 1, waste paper 5, hay 2, rubbish 1, paper shavings 1.

The total of "flash fires," as represented in the *a*, *b*, *c*, and *d* items above is 121, indicating that well over 50 per cent of the fires of the kind here considered present conditions for rapid combustion.

Obstruction to the distribution of water by automatic sprinklers is another cause for widespread opening of sprinklers. The reports furnish 38 instances of this, as follows:

(*e*) DEEP PILING OF MATERIAL OR STOCK, total 8—
Jute 1, cotton 2, rubber 1, cork in cases 1, cork in bales 1, cardboard 1, old signs, etc., 1.

(*f*) EQUIPMENT, ETC., total 30—

Small enclosures 3, clothes lockers 2, decks and shelves 8, benches 2, cutting and sewing tables 9, show cases 1, large ducts 1, large machines 1, automobiles 2, Jacquard looms 1.

(*g*) **Dryers,** both sprinklered and unsprinklered, regardless of construction, are rightly regarded as making troublesome fires, the reports furnishing 30 such instances, as follows—

Cotton stock dryers 9, wool carbonizing 3, felt 1, cloth 2, laundry 1, hair 1, silk 1, lumber 4, linoleum (rack) 1, paint 1, laboratory 1, carbon black 1, tobacco 1, shade cloth festoon drying 2, miscellaneous 1.

(*h*) **Defects in Construction** have long been given attention as affecting the control of fire by sprinklers. The reports examined showed 17 instances in which some defect in construction was the predominating factor—

Hollow walls 1, hollow floors and roofs 6, high ceilings 1, vertical openings 7, joist channels 2.

(*j*) **Miscellaneous Unfavorable Conditions** contributed 17 to the total as follows—

High air pressure on dry systems	2
Fires on roofs or on outside walls	4
Fires in paper machine hoods, etc.	6
Pocketing of heat in small areas	4
Not classified	1

The foregoing tabulation does not show the influence of draft conditions which entered into many cases, nor did the fire reports examined give satisfactory statements concerning this matter. With the fan arrangements usual for conveying fibre, wood waste, and various dusts, as well as for the operation of dryers, it appeared to be a safe assumption that the draft condition was an important factor in many of these fires. A review of the data indicates that in at least 38 of the fires the combustion was encouraged by artificial drafts.

No claim is made for the foregoing figures other than that they indicate in a general way the relative importance of the various factors influencing the promptness of control of fire by modern sprinkler equipments. It should be remembered that many flash fires are soon out, and that with all due respect to the flash fire hazard, the hazards of dryers and of obstructed distribution are of great importance.

Domestic Oil Burners.

Continued inquiries from N. F. P. A. members about the hazard of oil burning equipments of the domestic type have lead to the compilation of this fire record, which supplements the data on this subject published in the last two numbers of the QUARTERLY.* While a certain proportion of the fires reported are due to defective equipment or installation, it appears that the majority of the fires are caused by imperfect combustion of the oil, by reason of improper operation or of inadequate draft. In most of the fires reported in this summary the actual fire loss is small, the principal damage being from the heavy smoke given off by the burning oil. In a few cases reported the actual fire did not extend beyond the furnace, but heavy smoke damage resulted throughout the house.

Many of the difficulties encountered seem to be due to the installation of oil burners not suited to furnaces and chimneys originally designed for coal burning equipments. Oil burners may give hotter and more continuous fires than are ordinarily obtainable with the coal burning equipments previously used, thus bring to light defects in installation and chimney construction which were not noticed when coal was burned. Some fires are reported as due to this cause. That there are not more fires in this classification is probably due to the inspection given to chimneys and flues at the time when oil burning equipments are installed in old furnaces.

Not only must there be adequate draft to carry off the products of combustion in the case of the oil burner, but there must be a proper adjustment of the draft and the burner if soot is not to be formed. One factor which may be responsible for the difficulties encountered with some oil burning equipments is that in order to secure efficient combustion in the case of oil a considerable "combustion space" is required above the burner, a space in which the vapor generated from the oil may combine with the air. A similar space is required for coal fires, but it is said that a smaller space suffices in the case of coal than in the case of oil. If there is insufficient combustion space and the hot oil vapors are cooled by contact with the surface of furnace flues or pipes before they have had time to combine with the air, rapid accumulation of soot on such surfaces

* Safeguarding Domestic Oil Burners, by Curtis R. Welborn, October, 1923, Vol. 17, No. 2, p. 142; Domestic Oil Burner Fires, January, 1924, Vol. 17, No. 3, p. 271.

is likely. Difficulties of this kind, however, should be largely eliminated by proper installation methods and as experience with the oil burner increases not only should the devices and methods of installation improve, but the householder should become more familiar with the proper operation of the burners and the fire hazard should be progressively diminished.

Boston, Mass.

Chief John Taber (Member N. F. P. A. of the Boston Fire Department has made a survey of the oil burner situation in Boston and reports sixty fires due to oil burning equipments during the past two seasons. These fires are classified as follows:

Cause of Fire	No. of Fires
Ignition of soot in chimney	32
Defective installation	11
Overflow of oil	7
Backfire	4
Leaking oil	3
Heat ignited surrounding woodwork	3
Total	60

Many chimneys built for coal burning furnaces are not of sufficient capacity to take care of the soot from oil burning equipments. In a number of cases these chimney fires occurred after the burner had been shut off. The oxygen from the fresh air coming down the chimney caused the ignition of the oily soot which had adhered to the chimney.

Many of these fires were attributable to careless and unintelligent installation and operation of the systems. A good example of this is a fire which occurred on December 3, 1922. The heater was installed by a local company which went out of business shortly after this fire. A barrel of oil was set up on a bench in the cellar with gravity flow to the burner. The heat was more than the chimney could take care of and the headers around the chimney caught fire.

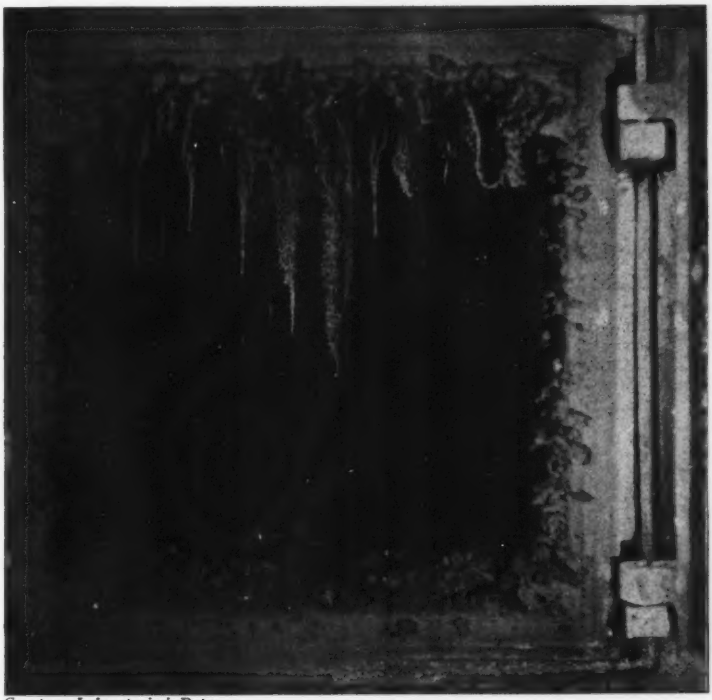
The following data on oil burner fires in Boston is furnished by Mr. I. Osgood (Member N. F. P. A.), Chief Engineer of the Boston Board of Fire Underwriters.

1. January 28, 1923. A cap became loosened from a nipple in the oil supply piping, allowing oil to leak on the floor in sufficient quantity to flow back into the ash pit where the oil was ignited.

This was an unapproved equipment, oil being supplied to the burner by gravity from a five-gallon storage tank.

Fire was extinguished by fire department with slight damage.

2. February 24, 1923. Fire was probably caused by the flame



Courtesy Laboratories' Data.

View through fire door of furnace showing carbon deposit after several days of faulty operation of an oil burner.

going out, thus allowing oil to flow into hot fire box and to generate gas in sufficient amount to cause a slight explosion.

This equipment was unapproved and was not equipped with a pilot burner.

Oil was stored in two 50-gallon drums from which it was fed to a 25-gallon tank near the heater. Connected to this tank was a second 25-gallon tank used as an air receiver, air pressure being created in this receiver by means of a hand pump.

The fire was of small consequence and was extinguished by the public department.

The oil burner has been removed and the use of coal resumed.

3. April 14, 1923. A leaking fitting allowed oil to flow into bottom of heater where gas was generated and a slight explosion was caused.

No damage resulted except from smoke. Fire was extinguished by fire department.

4. January 3, 1924. The "spinner cup" in an unapproved equipment in an apartment house became clogged with dirt. The oil dropped into the fire box and ran out on the floor in front of the furnace and ignited. The fire was extinguished by the night fireman without loss.

5. January 28, 1924. An unapproved equipment using a ten-gallon tank for oil supply, the flow of oil being regulated by air pressure created by a hand pump, was in use. In the bottom of the heater a pan had been placed to catch oil leaking from the piping. This oil became ignited when an attempt was made to start the burner and an explosion resulted.

Fire was extinguished by the Fire Department with slight damage.

6. February 11, 1924. Burner flooded with oil because of a lack of an automatic control device and burning oil ran out on the floor.

This system is supplied by a 50-gallon drum, the flow of oil being controlled by air pressure.

Fire department extinguished fire with slight damage.

Kansas.

The Kansas Inspection Bureau (Member N. F. P. A.) has furnished the following information about oil burner fires in Kansas:

The most common type of burner used in this territory is the gravity feed with bucket overflow cutoff. Very little actual damage by fire has occurred, but several instances are noted where for some reason or other the burner or cutoff failed to function properly and volumes of smoke came up into the house, causing serious damage. Some of these fires in residences are reported below.

TOPEKA, JANUARY 1, 1924. Gravity feed oil burner in furnace. Overflow cutoff failed to function properly. Ash pan filled with oil and finally ignited causing loss of about $250 to building and contents.

SALINA, JANUARY 11, 1924. Gravity feed type burner with bucket overflow cutoff was installed in the furnace. The burner is thought to have become corroded with soot. A small explosion occurred before the fire. Damage $320.

JUNCTION CITY, FEBRUARY, 1924. Owner was absent from home for two weeks but owing to the low temperature left oil burner in operation. Chimney became clogged with soot causing furnace to smoke profusely. While there was no damage from fire, the damage from smoke to the contents of the residence was estimated at about $10,000.

KANSAS CITY, FEBRUARY 7, 1924. Gravity feed burner with bucket overflow cutoff. Draft became choked causing imperfect combustion. Oil overflowed and automatic shutoff failed to cut off the flow entirely, with the result that the ash pit became filled and the oil therein ignited. Fire did not get out of the furnace, but a heavy smoke damage resulted.

TOPEKA, FEBRUARY, 1924. Burner clogged up and ash pit filled with

oil burning equipment on January 9, 1924 at New Orleans is reported by fire, but smoke damage was estimated at about $5,000.

Very few cases are reported where there has been other than small damage from fire. However, the damage caused by the smoke is generally very large.

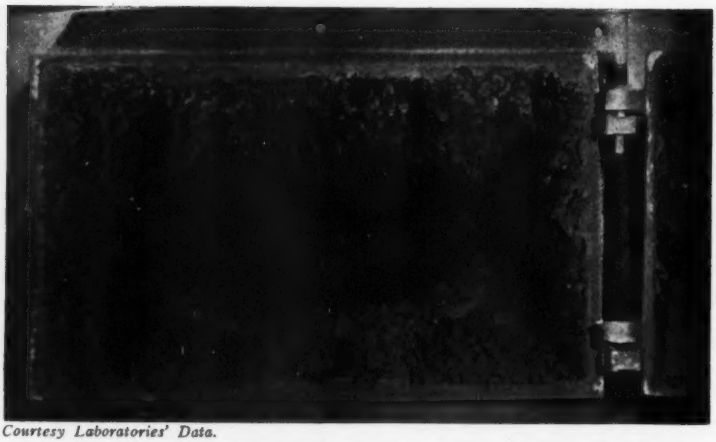
New Orleans.

An interesting and instructive report on a fire caused by a domestic oil burning equipment on January 9, 1924 at New Orleans is reported by the Louisiana Fire Prevention Bureau (Member N. F. P. A.).

The residence was a large, two-story, frame structure with first floor raised about two feet above grade. There was no basement. The heating system was a hot water system with boiler or furnace located beneath the building in a concrete pit. The space beneath the house was only partially enclosed and was therefore well ventilated. In the furnace was an approved automatic oil burner, controlled by a thermostat located in the first floor hall. Kerosene was used for fuel. The kerosene was stored in an underground tank of about 300 gallons capacity, located in the yard. From this tank oil was pumped by means of a hand pump to an auxiliary tank of 60 gallons capacity, located immediately outside of building in a small enclosure constructed of sheet metal. From this last tank oil flowed by gravity to the burner. The burner was of the forced draft type, fan being connected to burner. Oil and air were mixed in the combustion chamber and ignited by means of a gas pilot light. The equipment was installed according to the Regulations for the Installation of Domestic Oil Burning Equipments. The wooden floor joists above furnace and pit were protected as required with sheets of ¼-inch asbestos covered with sheet metal. This oil burning equipment was recently installed and had only been in use for about one month.

Description of the Fire.

The owner stated that she had returned home after several hours absence during which time the burner had been turned off. Soon after entering the house she started the burner from the thermostat control on the second floor, and set the thermostat at the desired temperature. Shortly after this a strong odor of kerosene smoke was noticed throughout the house and the owner sent word to the chauffeur to go to the furnace pit and see what was the trouble. The chauffeur stated that he went to the furnace pit and found that the motor had stopped but the furnace was not smoking. Just as he left the pit he heard the motor start again and looking back he saw flame and smoke coming from the fire and clean out doors and spreading to the ceiling over the top of the furnace. He immediately ran to the telephone and called the fire department, then got out a length of garden hose and played water into the furnace pit.



Courtesy Laboratories' Data.

Looking into the clean out door of the furnace. Poor combustion of the fuel oil caused this.

The fire department arrived promptly but by that time the smoke was so dense that they had some difficulty in getting into the furnace pit. However, the fire was soon extinguished. Several of the hot water pipes leading from the furnace were covered with hair felt pipe covering and this caught fire in several places and added to the density of the smoke.

The damage from the fire was slight as the metal and asbestos fireproofing protected the woodwork from flames, and none of the floor sills or joists were damaged.

When an investigation of the fire was made the next day, the burner was found intact and there was no evidence of there having been fire anywhere except on the ceiling over the furnace pit, and the front of the furnace. The contractor who installed the burner started it up in the presence of the inspector and flame and smoke began to pour from the front of the furnace through slots in fire doors and clean out doors exactly as the chauffeur had described the fire which occurred the evening before. This seemed to indicate trouble with the draft and as the damper was found open there was apparently some obstruction in the smoke pipe or chimney. The metal flue, about 12 feet long, ran horizontally from the furnace and entered a brick chimney near the bottom. The smoke pipe was taken down and a large accumulation of soot and plaster was found where the pipe entered the chimney. This deposit had practically closed off all draft up the chimney. With the draft cut off, flames and smoke from the burner, fed by forced draft, burst through the doors at the front of the furnace. The oil burning without sufficient air made the combustion incomplete which caused dense black smoke.

During the past two years approximately 300 oil burners, installed in residences in the city of New Orleans, have been inspected by this Bureau. These burners are of various makes and are installed in different types of furnaces. This and one other similar fire are the only two that have been reported during this period caused by oil burning apparatus and both of these fires were apparently due to imperfect draft conditions as outlined above.

Conclusions.

This fire emphasizes the necessity of maintaining adequate draft to insure complete combustion of the oil. It is recommended that before oil burners are installed that stacks and flues be thoroughly cleaned out, and to insure good draft the supply of oil to the burner should then be adjusted so that the supply cannot exceed the amount that can be completely consumed in the furnace. If combustion is incomplete, carbon (soot) deposits will accumulate in the stack and obstruct the draft. This impairment of draft will increase the formation of soot or carbon in the stack.

A series of experiments with oil burners has been conducted recently by the Underwriters' Laboratories. It has been found that oil burners operating with insufficient draft incompletely burned the oil and heavy carbon deposits in the fire box and smoke flues resulted. In some cases a week's accumulation of soot was sufficient to close almost entirely the opening to smoke pipe. (See illustrations.)

The above fire also brings out the value of fireproofing of all woodwork near the furnace, for had not the woodwork above this furnace been properly protected, there is no doubt that the building would have caught fire.

St. Paul.

Details on three recent oil burner fires have been furnished by Mr. John Townsend, Jr. (Member N. F. P. A.), Superintendent of the St. Paul Fire Insurance Patrol.

1. The burner was of the gravity feed type and the flow of oil was improperly regulated. The smokepipe consequently filled with soot which caught fire. The house was badly smoked up but the fire loss was negligible.

2. In this installation the smokepipe leading from the furnace to the chimney slanted down instead of up and the soot collected in the pipe until it was completely stopped up. The gas which formed in the furnace exploded and blew the doors off. The burning oil was scattered about and ignited a wooden partition. The fire was extinguished with small loss but the smoke damage was large.

3. A home-made burner burning discarded automobile crank case

lubricating oil was installed in a garage. The furnace had been lighted but was allowed to go out. Later one of the employees turned on the oil and then opened the door to light the burner. The furnace was hot enough to form gas when the oil was allowed to run in and opening the door admitted sufficient oxygen to cause an explosion. The man was badly burned. The fire was extinguished with small loss.

The Lawrence Building Fire, Montpelier, Vt.

The Lawrence Building on Main Street, Montpelier, Vermont, was destroyed by fire on the morning of February 15, 1924, with the loss of eleven lives. The building was an ordinary brick joisted structure of four stories and basement erected in 1896. It was occupied on the first floor by a retail hardware store, a retail grain and feed store, and a grocery store. On the second floor were various offices and on the third and fourth floors were apartments with a small private dance hall on the fourth floor. There was a wide, open stairway from the street to the second floor and an open galleried shaft extending from the second floor to the roof, with a thin glass skylight at the top. There was a fire escape at the rear which opened into the dance hall on the top floor and a private apartment on the third floor. All of the doors to the rooms leading to the fire escape were kept locked. There were no signs indicating from the corridors where the fire escape was located.

Story of the Fire.

The fire started in the hardware store shortly after midnight. The fire burned for some time, finally generating enough gas to cause a smoke explosion which communicated the fire to all parts of the building. The fire was first noticed by a man on duty in the police station next door who looked out of the window and saw the whole end of the building in flames.

The fire department consisting of a chief and five permanent men responded. Upon their arrival the first and second stories were all ablaze and tenants were trapped on the upper floors. The ladders on the truck which responded were too short to reach the upper stories, and as the regular ladder truck was located at some distance from the center of the town in the city stable and was procured by a call man not directly

Data furnished by courtesy of A. R. Ellis (Member N. F. P. A.), G. O. Stratton, President of the Vermont Mutual Fire Insurance Co. (Member N. F. P. A.), and The Underwriters Bureau of New England (Member N. F. P. A.).

Ruins of the Lawrence Building at Montpelier, Vt., destroyed by fire on February 15, 1924. Eleven persons were burned to death in this fire.

notified of the fire, it arrived too late to be of value. Life nets were put in operation but these were not handled to the best efficiency as the department was shorthanded. The fire whistle failed to complete the alarm, resulting in considerable delay in getting the call men to the scene. Seven people were saved by the nets. Two lost their lives by missing the nets. A number of those rescued received severe injuries. Nine occupants were cut off from escape and were suffocated or burned to death.

The fire was fought with twelve hose streams. The water supply was satisfactory throughout. The fire was brought under control in about four hours. Adjoining buildings were not damaged. The loss to the property was approximately $150,000.

Conclusions.

This fire again emphasizes the great danger to life in allowing upper floors over mercantile and manufacturing occupancies in buildings of ordinary construction to be occupied for dwelling purposes, especially where there are inadequate exit facilities, and in smaller cities and towns not equipped with adequate life saving devices.

The remains of the one fire escape at the rear of the building. The doors leading to this escape were locked.

The open stairway from top to bottom of the building as usual acted as a flue for the fire and cut off escape for the occupants.

The fire escape proved practically useless as a means of exit. The Vermont law does not require fire escapes on buildings of this kind occupied by tenants, other than for the accommodation of an amusement or public hall located in the building.

The importance of adequate apparatus and personnel for fire fighting is amply demonstrated.

An Interesting Sprinkler Failure.

Report by Underwriters' Bureau of New England.
(Member N. F. P. A.)

A fire which occurred at 11:50 P. M. on February 13, 1924, destroyed several buildings of a Massachusetts rubber working plant. The fact that the buildings were equipped with a standard dry pipe sprinkler system makes the fire of especial interest.

Construction and Occupancy.

The plant consisted of two groups of frame buildings, three stories or less in height, connected by a frame covered unsprinklered passageway 160 feet long extending across a pond. The passageway had been recently enclosed and sprinklers were to have been installed in it. The two groups of buildings were 75 feet apart at the nearest point and each group was considered a separate fire section.

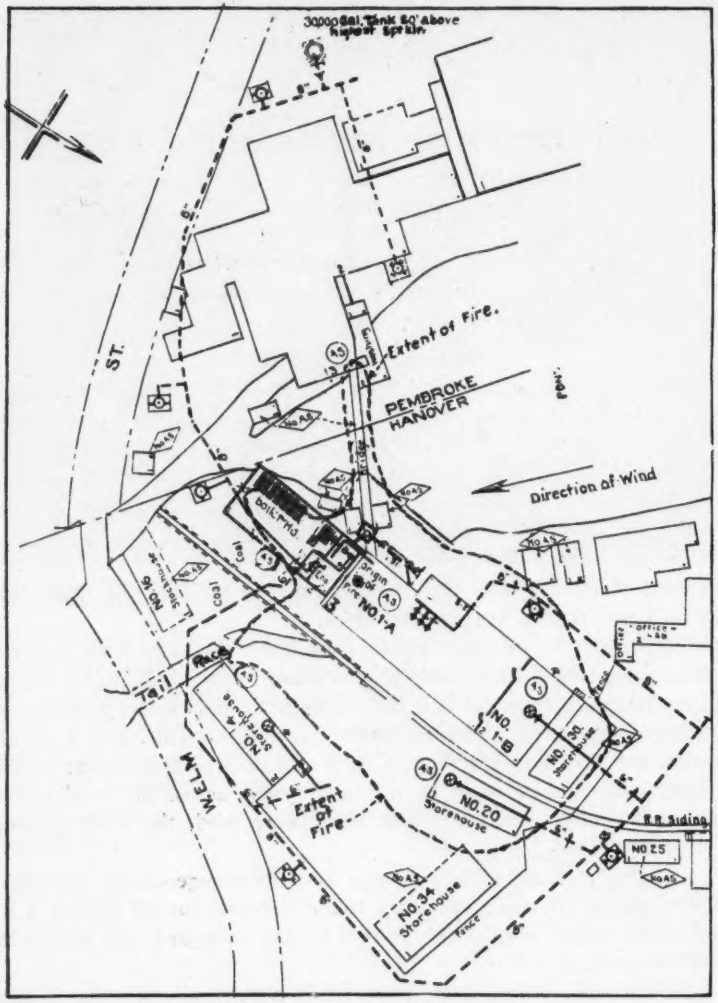
The east group located in the town of Hanover was used for the preparing of stock. The west group located in the town of Pembroke was used for treating the prepared stock.

Old rubber of all descriptions constituted the raw stock and reclaimed sheet rubber the product of this plant. In the buildings involved the stock handled consisted of solid rubber truck tires without fabric but containing sulphur lampblack and other ingredients. This stock was cut, ground, and sifted in Building 1 A, a two-story and basement frame building, and then conveyed by a blower system across the pond to the other mill section. Metal blower pipes were used, the stock passing through the fan.

Building 1 B, adjoining 1 A, was used for storage of raw stock and finished goods. It was a two-story frame building, cut off from 1 A by a 12-in. brick wall winged only 3 or 4 in. and parapeted only 2 or 3 in. above the roof of 1 B.

Building No. 30 was a one-story frame metal clad storehouse located 10 feet north of 1 B. This building was used for storage of chemicals and was unsprinklered.

The Power Plant adjoining 1 A on the south was a one-story brick joisted building, cut off from 1 A by a blank brick wall parapeted above the engine room but not extending as high as the roof of 1 A, which was five feet distant.



Plan of the rubber working plant.

The unsprinklered passageway extended from Building 1 A near the corner of the Power Plant and was so located as to render the fire wall of little value.

Preparing Process.

In the preparing building (1 A) the processes were mainly confined to the south end nearest the engine room. Solid rubber tire stock was

first cut into small pieces on the second floor, and then taken to a "cracker" on the first floor. The cracked stock was raised by a frame enclosed stock elevator, sprinklered at the top, to the third floor, then dropped to grinder hoppers on the second floor through a frame chute. These hoppers were equipped with magnets to prevent metal from passing into the grinders. The stock after being ground was again elevated to the third floor where it passed through three tier sifters, the smallest being about 30 to 32 mesh to the inch. The sifted stock passed through the third floor into open screw conveyors located near the ceiling of the second floor which deposited it on a screen, from under which it was taken by the blower system above described to the Pembroke mill. The grinder which had been operating was shut down a short time previous to the fire.

Fire Protection.

All buildings described above except the storehouse were equipped with modern dry pipe sprinkler systems. Pipe sizes and spacing were practically standard and dry valves were not overloaded. The buildings across the river were also equipped with sprinklers.

The water supplies consisted of a 30,000 gallon gravity tank, 20 feet above the highest sprinklers, located on the Pembroke side of the river, and a 1,000 gallon steam pump located in engine room adjoining Building 1 A. There was a long run of pipe from the tank to the dry valves in Building 1 A, where the fire started, namely, 1,640 feet, all of which, except 285 feet of 6-in. pipe near the middle of the run, was 8 in. in size. The run of pipe from the pump to the above dry valves was about 1,110 feet, which included the 285 feet of 6-in. pipe above mentioned.

There were numerous private hydrants in the yard system supplied by both tank and pump with an adequate equipment of hose. The plant was isolated; the nearest volunteer fire department was one mile away, pumpers were located in several towns within a 12-mile radius. There was no organized fire brigade, but at the time of the fire there were 25 men in the Pembroke mill and five in the Hanover mill, and three or four others available for fire fighting.

Story of the Fire.

The weather on the night of the fire was cold (2° below zero) but there was not much wind. The plant was running with a night shift of about 30 men, and with two watchmen also on duty. The exact cause of the fire is unknown, though it seems probable that it was due to a hot bearing. There were several bearings and motors near the ceiling, near where the fire started, including blower and sieve shaft bearings. Fire was discovered on the second floor of Building 1 A on the ceiling near the screw conveyor at 11:50 P. M. by the night superintendent. He used a

hand chemical extinguisher without result and then ran to the engine room nearby and had the engineer blow the steam whistle. A line of hose was taken from the pump and run out of a window but it was probably ten minutes before the pump was started. The superintendent and one employee tried to enter the passageway with a hose line but found that fire had already entered this unsprinklered section and was being drawn rapidly toward the Pembroke mill. They were soon driven away by the fire and probably dropped the hose which continued to waste water as long as the pump ran.

Looking towards the fire from the frame unsprinklered passageway.

The superintendent then went to the Pembroke mill, organized the men there, and succeeded in stopping the spread of the fire in that direction by the use of three hydrant streams, two streams from small duplex service pumps and a 40-gallon wheeled foam extinguisher.

Four sprinklers in the Pembroke mill also operated and assisted in holding the fire. The damage on this side of the river is probably not over $1,000 and great credit is due to these employees for stopping the fire at this point.

Meanwhile the night watchman and employees on the Hanover side, with the assistance of an outsider, connected a hose line to the hydrant near the mill office building, this being the last hydrant on the line from the water supplies and the nearest to the dry valves that first operated. This gave such a poor stream as to be practically useless. The valves on this hydrant were examined at this time and found to be wide open. Streams from other hydrants on the Hanover side were then tried with similar results. Probably at least eight hose lines had been laid by 12:15 A. M.

Sprinklers were seen in operation near where the fire started prior to 12:15 A. M. but the water pressure appeared to be light. One man entering the building about 12:10 A. M. stated that the fire was ap-

parently confined to the entrance of unsprinklered passageway and to the small unsprinklered buildings nearby. The use of additional hose streams soon robbed the sprinklers in Building 1 A of any effective water supply.

Help was called from neighboring towns and pumpers were sent without delay. These pumps were located at different points on the pond and river and rendered great aid.

At about 1 A. M. the fire had passed from Building 1 A to 1 B around the fire wall which was not properly winged or parapeted. This wall was badly spalled and later collapsed. One man entered 1 B about this time and reported that fire doors were all closed and sprinklers were in operation in 1 B but under light pressure.

Three of five freight cars on a siding adjoining Building 1 B and 30 were removed and the others were burned.

Fire spread to the roof of the pump house early in the fire, being communicated from the frame passageway. The roof fire was extinguished in part by a direct stream from the pump but it gained such a hold that the engineer was forced out about 12:45 A. M. From that time until about 2:30 A. M. the pump operated without attendance.

A large steam main supported by the passageway across the river was broken by the collapse of the passageway and the fire was drawn from under three of the boilers. The valve to the broken main was shut so as to conserve the steam supply. Boilers left in service were two of horizontal tubular type and two large Dutch oven type with hopper feed. When fire extended to the roof of the boiler house, one stream was used from inside in addition to the sprinklers that operated. Water from the sprinklers flooded the hopper magazines of these boilers and extinguished the fires. The other two boilers were fired until boiler room became untenantable and men left. Steam then died down and pump stopped operating between 2:15 A. M. and 2:30 A. M. The fire on the boiler and pump house roof was extinguished by the local department.

It should be noted that up to the time of steam failure quite good streams were obtained from private hydrants on the Pembroke side of the plant, while hose streams on the Hanover side were so poor as to be of no value. This was apparently due to residual pressure at the pump discharge resulting from the length of old 6-in. pipe leading to the hydrants and sprinklers on the Hanover side.

Outside fire department pumps stopped the fire from extending in an easterly and northerly direction. A group of unsprinklered buildings were saved by the local chemical and a bucket brigade.

When Building 1 A collapsed the post indicator valve controlling the water supply to this building was not shut. This caused considerable wastage into the ruins.

Action of Automatic Sprinklers.

The sprinklers failed to hold this fire because of several causes. The sprinkler heads undoubtedly opened promptly but there was some delay in delivery of water due to the fact that there was about 27 lbs. air pressure in the pipes and only about 30 lbs. water pressure below the dry valves.

Tests recently conducted on dry pipe valve operation under conditions as closely similar as possible to those present in this case, indicate that nearly two minutes elapses between the opening of one sprinkler and the tripping of the dry valve, when both the water pressure and the air pressure are between 25 and 30 lbs.

Building 1 A was provided with three dry valves on a header with a gate valve under each. These were supplied by an 8-in. connection from the yard main controlled by a post indicator valve about 40 feet from the building.

These valves were all open, so far as could be determined after a careful investigation. There is always a possibility of a valve being shut for part of the time and later opened, but there is no evidence that such was the case in this instance. After the fire, all dry valves were found tripped with clear water-way. Inside valves were wide open with outside stems bent.

The features most likely to account for the failure of the sprinklers are as follows: (1) Fire started on the joisted ceiling where sprinklers could not wet down the whole area effectively and where there was some obstruction to distribution due to conveyors, chutes, shafts, fans, motor, etc. (2) Draught conditions carried fire to the unsprinklered passageway and detached building and to the frame exterior of the main building. (3) Water pressure was low and friction loss was large, due to long run of yard pipes and length of old 6-in. pipe.

The combustible rubber dust tended to cause a flash fire and also gave off combustible gas when heated. It is also apparent that too many hose streams were used early in the fire, thus reducing the effective pressure on the sprinklers.

While there is evidence that the sprinklers did have some effect in the first ten minutes of the fire, the fire spread owing to these causes and soon was beyond sprinkler control. There was not enough water available from the tank and pump to subsequently control the fire by means of hose streams.

Another New York Tenement Holocaust.

Report by New York Board of Fire Underwriters
(Member N. F. P. A.)

A fire which occurred at 12:22 A. M. on February 19, 1924, in a tenement at 397 Madison Street, New York, caused the death of fourteen persons.

Construction.

The building was of ordinary brick construction, five stories and basement. The walls were of 12 in. brick and partitions were of wood lath and plaster with wooden doors. The floors were single boards on joists. Ceilings were of wooden lath and plaster and skylights were of thin glass. There was one open stairway running from the bottom to the top. In the rear there was a fire escape upon which thin glass windows faced.

Occupancy.

The first floor was occupied by a tailor and by an ink and mucilage company. The upper four floors were occupied as dwellings with two families on each floor in three-room apartments.

Story of the Fire.

The fire apparently originated in the rear of the basement at the foot of the cellar stairs. The fire spread rapidly through the stair shaft and mushroomed out at the fourth and fifth floors and through the windows leading to the fire escape. The alarm was given by a policeman and the fire department responded promptly. A second alarm was turned in at 12:29 A. M., seven minutes after the first alarm. The firemen made heroic attempts to rescue the occupants but the smoke was intense and a number of tenants were suffocated in their beds. Some escaped through the roof scuttle. One man jumped from a window and was killed. Two families might have been saved by jumping from their bedroom windows to the roof of the adjoining building from four to ten feet below.

The wooden stairway was badly burned above the second floor and the fourth and fifth floors were partly destroyed.

Conclusions.

The inflammable construction of stairs, stair enclosure and partitions, undoubtedly contributed largely to the spread of the fire and particularly to the loss of life. The importance of having the stairs enclosed in a shaft of fire-resistive construction with fire doors at all communications to inside of building is apparent. Wired glass in windows facing the fire escape would probably have saved some loss of life.

Underwood and Underwood.

This fire escape was useless as flames burst out of the thin glass windows facing it. Fourteen persons were burned to death in the building.

The lessons of this fire have long since been learned and the defective conditions which contributed to the loss of life in this case have long been prohibited by law in the erection of new buildings.

The frequent loss of life in such so-called old law tenements emphasizes the dangerous conditions which exist and the urgent need of some better safeguards, particularly against loss of life by fire.

The Omaha Steel Works Fire.

Report by Nebraska Inspection Bureau.

(Member N. F. P. A.)

The lack of fire resistance offered by buildings of unprotected structural steel construction has been demonstrated many times but there has seldom been a better example of this than the fire which partially destroyed the plant of the Omaha Steel Works at Omaha, Nebraska, on February 5, 1924. In this fire one building of skeleton steel construction was destroyed and another building, the structural steel shop, 25 feet distant, was severely damaged, although of non-combustible construction. This fire serves to refute again the common popular fallacies that a building of non-combustible construction is "fireproof" and that in an occupancy devoted principally to the manufacture and storage of non-combustible product there is "nothing to burn."

The fire started in the building on the right, which was of steel construction that would have been called "fireproof" by the layman. The building was occupied by a steel works, where the layman would think there was "nothing to burn." The space between these buildings was 25 ft. Note the condition of windows, metal walls and iron roof of the exposed building on the left.

The effect of heat on unprotected steel. Note the condition of the structural steel member partially protected by the brick apron wall as compared to that portion above not protected.

The fire originated in a one- and two-story building of skeleton steel construction with brick apron walls and frame gables. The roof was of metal on wooden sheathing and corrugated metal on iron supports. The roof supports were steel trusses, beams, and girders, without fireproofing. The floors were of wood and concrete. This building was occupied for office purposes and also contained a compressor room, pattern shop and ornamental iron shop.

The exposed building was a one- and two-story structure with brick apron walls five to ten feet high and iron and glass walls above, all steel being unprotected. Two theories have been advanced as to the probable cause of the fire which started in the compressor room: that a short circuit caused a spark which ignited sawdust on the floor near some barrels of lubricating oil; or that a slipping belt on the air compressor accomplished the same result.

One of the men on the night force, who was in the machine shop at one end of the building, discovered the burning sawdust on the floor. He and other employees endeavored to put out the fire on the floor by throwing earth on it. They succeeded in this but not before the combustible material in the roof structure had ignited. No attempt was made, so far as is known, to use a standard chemical fire extinguisher installed in the pattern shop and easily accessible. The fire was discovered about 1:30

A. M. The first fire department alarm was turned in at 1:37 A. M. A second alarm followed at 1:58 A. M. Eight companies responded to the two alarms. Zero weather prevailed and a strong northeast wind made the work of the fire department difficult and aided the rapid progress of the fire.

The fire was finally controlled about 9 A. M. after completely destroying the building in which it originated. The exposed structural steel shop was badly damaged on one side, all glass for a length of approximately 250 feet being broken out and the steel framing damaged by heat. Two or three other adjacent buildings were slightly damaged.

In addition to the cold and the high wind, a shortage of water during the early stages of the fire hampered the fire department. One hydrant was on a six-inch dead end main fed for a distance of a block through a four-inch main. Another hydrant was attached to the same dead end system.

The total loss of one building and heavy damage to the exposed building clearly demonstrates the value of standard fireproofing of all steel structural members.

The Capitol Hotel Fire, Houston, Texas.

By J. B. Collins

(Member N. F. P. A.)

A fire which occurred on December 18, 1923, destroyed the Capitol Hotel and a group of stores at Houston, Texas, and caused the death of four persons residing in the hotel.

Construction.

The building was an old brick structure, entirely of wooden construction in the interior. There had been apparently little or no thought given to fire protection either in the construction or operation of the building. The first floor was taken up with stores and the hotel lobby and the second and third floors were used for sleeping rooms. There was only one central stairway. There were two fire escapes leading from guest rooms but not accessible to the hallways or to other rooms.

Story of the Fire.

The fire started about 6 A. M. from a short circuit in the electric wiring near the elevator on the third floor and was not discovered until the rear end of the building was seriously involved. The fire spread rapidly through the open hallway and down to the second floor through the open elevator shaft and the adjacent stairway, which was entirely unprotected. The life loss was partly due to persons being overcome by smoke

Ruins of the Capitol Hotel, Houston, Texas. Four persons were burned to death because of inadequate exits. The fire escape shown in the illustration was not accessible from the hallway.

before they were awakened and partly because of inability to reach exits. Most of the occupants of the upper floors were rescued by being carried down ladders. The building burned very rapidly and efforts of the fire department were concentrated on saving lives and protecting adjoining buildings.

Conclusions.

The loss of life would probably have been reduced or eliminated if there had been more adequate exits; if, for example, there had been protected stairways at both ends of the hallway, or if fire escapes had been directly accessible from all rooms.

An automatic alarm system might have resulted in the more prompt discovery of the fire and arousing of the guests. Probably the only really satisfactory protection for a building of this kind would have been a complete automatic sprinkler installation.

Fires in Which There Was Loss of Life.

These notes are intended to point out typical conditions under which loss of life has occurred, that they may be known and guarded against.

Oil Engine.

H-19762. BAXTER SPRINGS, KANSAS, JUNE 7, 1923. The backfire of an engine started a fire in the engine room of a zinc mine. The room was oil soaked and the fire spread rapidly. A hoist operator was pulling a man up out of the mine. The fire got close to the operator and he lost his head and ran from the hoist control apparatus leaving the man halfway up the shaft. The derrick caught fire and burned down letting the man fall to the bottom of the mine. The property damage was large.

Automobile Wreck.

H-19833. HINGHAM, MASS., AUG. 24, 1923. Two men and a woman were burned to death when their touring car caught fire after striking a heavy motor truck which had stalled on the road. The machine, which was traveling at high speed around a curve, hit the rear end of the truck and overturned, pinning the occupants underneath so that they were unable to escape the flames which followed the collision. Other autoists tried to extinguish the blaze and release the occupants without success.

Defective Electric Wiring.

H-19815. SAN ANTONIO, TEXAS, SEPT. 2, 1923. The fire occurred in a two-story frame rooming house occupied by Mexicans. The fire was caused by a short circuit in the electric wiring. The wiring had been installed about twenty years ago and was a substandard exposed installation. The fire spread rapidly and a woman who was forced to jump from a second story window was severely injured and died the next day. Another woman sustained a broken arm and four other occupants were slightly burned. The building was destroyed.

Gasoline.

H-20256. TITUSVILLE, PA., OCT. 30, 1923. A tank car containing casing head gasoline was on a railroad siding adjacent to an oil refinery. Two employees removed the manhole cover of the tank car in order to get samples. The wind carried the escaping gasoline vapors toward a cracking still 90 feet distant. The vapors ignited and flashed back to the tank car. A terrific explosion occurred, killing the two employees and

also a woman who was passing by the plant. The explosion scattered the burning liquid to a frame barrel house adjoining and this building was destroyed. The fire department prevented further spread of the fire.

Benzine.

S-36747. OSWEGO, N. Y., Nov. 2, 1923. Some benzine was being transported in a 40-gallon steel drum on a truck. The bung had not been replaced in the drum after filling and in landing on the second floor from the elevator, the drum rolled off the truck, spilling the benzine out on the floor and down the elevator shaft. From some unknown cause, presumably an electric spark, the benzine vapor ignited and flashed up the shaft. An employee at the landing on the second floor was instantly burned to death. Two other employees entered the shaft in an attempt to rescue the man and both were so badly burned that they afterward died. The fire was subsequently extinguished without property loss by one sprinkler head in the shaft and by hand chemical extinguishers.

Matches—Smoking.

H-20127. SAN ANTONIO, TEXAS, Nov. 29, 1923. A motion picture actress was sitting in an automobile waiting for her cue. She was dressed in the crinoline of the Civil War period. A carelessly flung match fell into her lap and ignited her clothing. She jumped from the car and started to run but two members of the company caught her and extinguished the flames. She died the next day from the burns.

H-20257. BUFFALO, N. Y., DEC. 1, 1923. This fire occurred on the second floor of a five-story brick joisted warehouse. Considerable amounts of excelsior and packing material were present on this floor. The exact cause of the fire was not determined but it is attributed to careless smoking. Employees in the building attempted to fight the fire with extinguishers but were driven back by the dense smoke of the excelsior and paper. Two men were overcome and suffocated. The fire department was hampered by the smoke but finally extinguished the fire with 24 hose streams. If there had been a sprinkler system in the building loss of life and property would have undoubtedly been prevented.

Unprotected Lumber Mill.

H-20211 LOUISVILLE, KY., DEC. 27, 1923. Fire of undetermined origin broke out in the packing room on the second floor of a four-story frame structure well stocked with seasoned dressed lumber. The fire spread so rapidly that employees barely had time to escape. Two men, said to have lingered to save their tools, were trapped on an upper floor and were burned to death. The only interior protection in the building was a supply of hand extinguishers. By the time the fire department

arrived the main building was completely on fire and two connecting warehouses were involved. All of the buildings of the lumber company were destroyed. Adjoining property was saved by the firemen.

If these buildings had been cut off by standard fire walls and protected with automatic sprinklers such a disaster would presumably not have occurred.

Gas Heater.

H-20246. BAKERSFIELD, CALIF., JAN. 2, 1924. A young woman was burned to death in her home when her clothing ignited while she was standing near an open flame gas heater. Her father was severely burned while attempting to beat out the flames. The house did not catch fire.

Conflagration.

H-20258. LYNDONVILLE, VT., JAN. 21, 1924. A fire which broke out at about 10:50 P. M. destroyed four business blocks and caused the loss of seven lives and the injury of several persons. The fire originated in a clothing store on the first floor of a three-story frame building. It is believed that the fire was of incendiary origin. The temperature was 10 to 12 degrees below zero and few people were in the vicinity. The fire probably burned for some time before it was discovered. A hot air explosion occurred and blew out the glass front of the store. Flames spread so rapidly that the building collapsed in 20 minutes. Many of the tenants of the building had retired for the night. Six persons failed to get out and were burned to death and one jumped from the third floor and sustained injuries which caused death.

The fire spread rapidly to other buildings and was quickly beyond control of the volunteer fire department. Aid from other towns finally arrived and checked the spread of the fire. The loss was approximately $400,000.

The hazard of large frame buildings with apartments located over stores is well illustrated by this fire.

Oil Tanks.

H-20259. PITTSBURGH, PA., JAN. 21, 1924. Seven firemen lost their lives while fighting a fire in an oil refinery. The fire was comparatively a small one. The pumping out line from the stills developed a leak and the leaking oil caught fire. Two firemen were on a forty foot extension ladder which had been put in position at one corner of a fire wall surrounding a battery of ten oil tanks. The ladder was resting firmly against the top edge of the fire wall and the top section of the ladder extended eight rungs above the top of the wall. Without warning the ladder snapped where it rested against the top of the wall, hurling the two men down on to the top of an oil tank about sixteen feet in diameter and twenty feet deep, which was covered with a wooden top on which a number of

firemen were standing. The impact caused a section of the roof to break through and the two firemen with five others fell through into the tank which was partly filled with wax oil covered with a heavy layer of foam. The men were quickly overcome by the fumes and before aid could reach them all were dead.

The fire was readily extinguished as soon as the stills were shut down.

Pyroxylin Plastic.

S-36791. GARFIELD, N. J., JAN. 30, 1924. The fire started about 10:45 P. M. in a one-story brick warehouse used for storing sheet and scrap pyroxylin plastic. The cause of the fire was not determined as the plant was destroyed in a few minutes. A watchman inside was suffocated by fumes but managed to reach an outside door. He fell in the doorway and firemen directed a large part of their efforts toward rescuing him but heat was so intense that they could not approach the spot for an hour.

Sprinklers were unable to cope with the fire and a 6-inch sprinkler line was broken off early in the fire which not only crippled the system but reduced the water pressure from the only nearby hydrant so that hose streams were not effective. Two lines were run from a pond across a railroad track but an express train cut both as the firemen did not signal the train effectively.

Children Locked in House.

H-20260. AMESBURY, MASS., FEB. 14, 1924. Three children, aged six, four and two, were left locked in the house while the mother went shopping. While the children were playing in the living room an overheated stove set fire to the woodwork in the kitchen. The children took refuge under a bed. An outsider noticed the fire and gave the alarm. The firemen broke in the doors and found the three children unconscious under the bed. The two younger ones were revived. The six-year-old boy was dead. He had been charged by his mother with the care of the younger children, and had made a futile attempt to extinguish the fire with a small shovel.

Inadequate Exits.

H-20457. PLAINFIELD, N. J., MARCH 21, 1924. A young man was burned to death in a small store. He was asleep in the rear of the store when an oil stove exploded. The fire cut off the front door and as there was no rear exit his escape was cut off. Firemen found the unfortunate man grasping the iron bars on a rear window making a frantic attempt to escape. They removed the bars and released him but he died shortly afterwards in the hospital. The fire was controlled with small property loss.

Annual Summary

Statistics of Fires in Properties Having Automatic Sprinkler Protection.

NOTE.—These tabulations are made at the close of each year, with the object of furnishing a basis upon which the virtue of the automatic sprinkler as an extinguishing agent can be estimated.

Section I is devoted to fires in which the behavior of sprinklers was, for the reasons given, unsatisfactory.

Section II is a statistical record of all reports of sprinkler fires in the files of the Association upon which the information obtained is sufficiently complete for statistical purposes.

In each table the results of the current year ending February 1, 1924, are given, and these are compared with the results of the total twenty-eight year record ending at that time.

Section III includes tables giving data on the efficiency of the primary water supply to sprinkler systems.

The total number of sprinklered fire reports received during the past year is 2665. The number of fires in which the sprinklers were not a factor* or which were discovered and extinguished before there was sufficient heat to open the sprinklers was 467. This compares with 624 for the year ending February, 1923, and 698 for the year ending February, 1922. The number of fires in which sprinklers operated is 2198 as compared with 1926 last year. The number of failures for the two years are respectively 98 and 83, making the per cent of satisfactory operation 95.5 and 95.7.

These tables show very few changes from the tabulation of the last few years. The sprinkler efficiency percentage figures have been almost identical for several years. The total percentage of satisfactory performance of sprinkler systems for the year was 95.6 per cent, as compared with 95.7 per cent last year, and 95.7 per cent for the entire period 1897-1924.

The tables on Number of Sprinklers Operating show that 78 per cent of the fires during the year were extinguished with five or less heads operating. Comparing wet and dry systems in this respect, 82 per cent of the wet system fires were extinguished with five or less heads and 56.3 per cent of the dry system fires.

In Table No. 8 it is interesting to note that of 1,352 clothing factory fires sprinklers have failed in only 11 fires, less than one per cent. Sprinklers have performed satisfactorily in 98.9 per cent of the 6,579 cotton mill fires recorded, 99.5 per cent of the 214 dry goods stores fires, and 98.3 per cent of the 523 mattress factory fires.

*By not a factor is meant fires that occur in unsprinkled portions of a building.

SECTION I.

Summary of Unsatisfactory Sprinkler Fires.

	1923-1924		1897-1924, incl.	
	No. of Fires	Per Cent	No. of Fires	Per Cent
Water shut off sprinklers	28	28.5	388	29.3
Generally defective equipment	6	6.1	267	20.2
Unsprinklered portions	12	12.3		
Defective water supply or supplies	7	7.1	118	8.9
Sprinkler system crippled due to freezing	1	1.0	42	3.2
Slow operation of dry system or defective valve	3	3.1	36	2.7
Slow or defective operation of high test heads	1	1.0	23	1.7
Faulty building construction, concealed spaces, vertical openings, etc.	6	6.1	68	5.1
Obstruction to distribution	8	8.2	78	5.9
Hazard of occupancy too severe for average sprinkler equipment	5	5.1	75	5.7
Explosion crippled sprinkler system	3	3.1	58	4.4
Exposure or conflagration	1	1.0	72	5.4
Plugged heads (included with Miscellaneous prior to 1921)	5	5.1	11	.8
Miscellaneous	12	12.3	89	6.7
Total	98		1325	

Special Classification of Fires in Which Failure Was Due to Water Being Shut Off Sprinklers.

	1923-1924 No. of Fires	1897-1924 No. of Fires
Water shut off for unknown reason, neglect or carelessness	7	141
Water shut off before fire was out or fire re-kindled	5	59
Water shut off due to accidents or repairs	1	61
Water shut off to prevent freezing	11	84
Water shut off, probably incendiary	..	6
Water shut off, leaky dry system	..	11
Water shut off, miscellaneous	4	19
Water shut off, defective gate valve	..	7
Total	28	388

SECTION II.

Annual Revision of Sprinkler Fire Tables.

In the following eleven tables is given a summary of fires occurring in properties equipped with automatic sprinklers. The total number of such fires reported during the past year is 2665, which includes 467 fires

where no sprinklers were opened. Several reports were also received in which the data was incomplete, and these were not used in the summary. It may be noted that the total number of fires does not agree throughout all the tables. This is because some of the reports of fires prior to 1909 were not considered sufficiently complete to include in all the tables, and hence appear in some tables, but not in others.

Table No. 1—Time of Day.

	1923-1924		1897-1924.	
	No. of Fires	Per Cent	No. of Fires	Per Cent
6 a. m. to 6 p. m.	1082	49.5	16090	56.0
6 p. m. to 6 a. m.	1103	50.5	12638	44.0
Total with data given	2185		28728	
No data	13		476	
Total	2198		29204	

Table No. 2—How Discovered.

	1923-1924		1897-1924	
	No. of Fires	Per Cent	No. of Fires	Per Cent
Employee	942	43.0	16017	56.0
Watchman	244	11.1	4145	14.4
Sprinkler Alarm	648	29.6	5302	18.5
Outsider	162	7.4	1598	5.6
Thermostats	47	2.1	826	2.9
Supervisory System	149	6.8	738	2.6
Total with data given	2192		28626	
No data	6		578	
Total	2198		29204	

Table No. 3—Efficiency of Alarm Service.

NOTE: This table does not include fires where alarm service does or does not operate promptly if fire is at once discovered by employees, the alarm service having no bearing on such fires one way or the other.

	Satisfactory.		Failure.		Total.
1923-1924.	No. of Fires	Per Cent	No. of Fires	Per Cent	
Watchman alone	106	95.5	5	4.5	111
Sprinkler Alarm alone	432	97.7	10	2.3	442
Thermostats alone	4	57.1	3	42.9	7
Supervisory System alone	3	100.0	..	..	3
1897-1924, Inclusive.					
Watchman alone	2313	91.1	225	8.9	2538
Sprinkler Alarm alone	3255	95.6	149	4.4	3404
Thermostats alone	225	80.9	53	19.1	278
Supervisory alone	63	98.4	1	1.6	64

Table No. 3—Efficiency of Alarm Service—Continued.

1923-1924.	Watchman. Satisfactory.	Watchman. Failure.	Sprinkler Alarm. Satisfactory.	Sprinkler Alarm. Failure.	Thermostat. Satisfactory.	Thermostat. Failure.	Supervisory. Satisfactory.	Supervisory. Failure.	Total.
Watchman and Sprinkler Alarm	128	93	211	10	..	..	..	..	221
Sprinkler Alarm and Thermostats	..	..	33	1	30	4	..	..	34
Watchman, Sprinkler Alarm, Thermostats,	1	7	8	..	5	3	..	..	8
Sprinkler Alarm and Supervisory	..	..	193	3	..	..	194	2	196
Watchman, Sprinkler Alarm and Supervisory	11	58	69	..	..	..	67	2	69
Sprinkler Alarm, Thermostats and Supervisory	..	..	13	..	12	1	12	1	13
Watchman, Sprinkler Alarm, Thermostats, Supervisory	..	3	3	..	3	..	3	..	3
1897-1924, Inclusive.									
Watchman and Sprinkler Alarm	1767	1201*	2659	309	..	..	..	..	2968
Watchman and Thermostats	20	10*	..	..	28	2	..	..	30
Sprinkler Alarm and Thermostats	..	..	612	46	520	138	..	..	658
Watchman, Sprinkler Alarm and Thermostats	50	91*	132	9	104	37	..	..	141
Sprinkler Alarm and Supervisory	..	..	954	18	..	..	962	10	972
Watchman and Supervisory	12	9*	..	..	..	..	21	..	21
Watchman, Sprinkler Alarm and Supervisory	117	338*	444	11	..	..	441	14	455
Sprinkler Alarm, Thermostats and Supervisory	..	..	99	3	86	16	100	2	102
Watchman, Sprinkler Alarm, Supervisory and Thermostats	1	4	5	..	5	..	5	..	5

*These include fires where sprinkler alarm or thermostat notified the watchman.

Table No. 4—Number of Sprinklers Operating.

No. of Sprinklers Operating	No. of Fires, 1923-1924 Wet	%	Dry	%	No Data	Total	%	No. of Fires, 1897-1924, incl. Wet	%	Dry	%	No Data	Total	%
1	744	41.3	73	20.3	5	822	37.9	9090	36.1	995	19.4	18	10103	33.4
2	359	19.9	48	13.2		407	18.6	4480	17.8	707	13.8	4	5191	17.1
3	188	10.4	39	10.7	2	229	10.5	2548	10.2	439	8.5	4	2991	9.9
4	128	7.1	24	6.6	1	153	7.0	1807	7.2	374	7.3	4	2185	7.2
5	60	3.3	20	5.5		80	3.7	1123	4.5	240	4.6	2	1365	4.5
6	49	2.7	21	5.8		70	3.2	903	3.6	232	4.4	3	1138	3.7
7	38	2.1	14	3.8		52	2.4	620	2.5	164	3.2	1	785	2.6
8	42	2.3	9	2.5		51	2.3	593	2.3	149	2.9		742	2.4
9	22	1.2	10	2.7	1	33	1.5	374	1.5	113	2.2	1	488	1.6
10	19	1.1	3	.8		22	1.0	345	1.3	98	1.9	1	444	1.5
11	7	.4	7	1.9		14	.6	251	1.0	96	1.9		347	1.1
12	15	.8	7	1.9		22	1.0	300	1.2	107	2.1	1	408	1.3
13	10	.6	3	.8	1	14	.6	164	.7	80	1.5	1	245	.8
14	13	.7	4	1.1		17	.8	193	.8	77	1.5	1	271	.9
15	4	.2	9	2.5		13	.6	152	.6	83	1.6	1	236	.8
16 to 20.....	34	1.9	10	2.7	1	45	2.1	544	2.2	229	4.5	3	776	2.6
21 to 25.....	17	.9	11	3.0		28	1.3	318	1.3	173	3.4		491	1.6
26 to 30.....	9	.5	9	2.5	1	19	.9	236	.9	111	2.2	1	348	1.1
31 to 35.....	3	.2	3	.8	1	7	.3	149	.6	69	1.3	2	220	.7
36 to 40.....	3	.2	8	2.2		11	.5	128	.5	71	1.4		199	.7
41 to 50.....	5	.3	6	1.6		11	.5	159	.6	99	1.9	1	259	.9
51 to 75.....	14	.8	10	2.7		24	1.1	221	.9	131	2.6	1	353	1.2
76 to 100.....	3	.2	7	1.9	1	11	.5	90	.4	65	1.3	2	157	.5
Over 100.....	16	.9	9	2.5		25	1.1	334	1.3	238	4.6		572	1.9
No Data	5		7		6	18		29		27		388	444	
Total	1807		371		20	12198		25151		5167		440	30758	
Water shut off sprinklers													270	
Total													31028	

Table No. 5—Number of Sprinklers Operating.

No. of Sprinklers Operating	No. of Fires, 1897-1924, inclusive. Wet	%	Dry	%	No Data	Total	%
1	9090	36.2	995	19.4	18	10103	33.4
2 or less....	13570	54.0	1702	33.2	22	15294	50.4
3 or less....	16118	64.3	2141	41.6	26	18285	60.2
4 or less....	17925	71.4	2515	49.0	30	20470	67.5
5 or less....	19048	75.8	2755	53.7	32	21835	72.2
6 or less....	19951	79.6	2987	58.2	35	22973	75.6
7 or less....	20571	81.8	3151	61.4	36	23758	78.2
8 or less....	21164	84.1	3300	64.4	36	24500	80.8
9 or less....	21538	85.7	3413	66.6	37	24988	82.4
10 or less....	21883	87.2	3511	68.3	38	25432	84.0
11 or less....	22134	88.0	3607	70.3	38	25779	85.2
12 or less....	22434	89.5	3714	72.5	39	26187	86.0
13 or less....	22598	89.9	3794	73.9	40	26432	87.2
14 or less....	22791	90.6	3871	75.5	41	26703	88.3
15 or less....	22943	91.2	3954	77.0	42	26939	88.8
20 or less....	23487	93.6	4183	81.5	45	27715	91.5
25 or less....	23805	94.8	4356	84.8	45	28206	93.2
30 or less....	24041	95.8	4467	86.9	46	28554	94.0
35 or less....	24190	96.2	4536	88.4	48	28774	94.6
40 or less....	24318	96.7	4607	89.8	48	28973	95.5
50 or less....	24477	97.4	4706	91.7	49	29232	96.5

Table No. 5—Continued.

No. of Fires, 1897-1924, inclusive.

No. of Sprinklers Operating	Wet	%	Dry	%	No Data	Total	%
75 or less...	24698	98.3	4837	94.1	50	29585	97.5
100 or less...	24788	98.7	4902	95.4	52	29742	98.1
Over 100....	334	1.3	238	4.6		572	1.9
No Data	29		27		388	444	
	25151		5167		440	30758	
Water shut off sprinklers						270	
Total						31028	

Table No. 6—Effect of Sprinklers, Wet and Dry Systems.

	1923-1924							1897-1924, incl.						
	No. of Fires.		No. of Fires.		No Data	No. of Fires. Total	%	No. of Fires.		No. of Fires.		No Data	No. of Fires. Total	%
	Wet	%	Dry	%				Wet	%	Dry	%			
Practically or entirely extinguished..	1329	73.6	228	61.5	8	1565	71.2	17190	66.9	3355	63.5	27	20572	66.2
Held fire in check	414	22.9	114	30.8	7	535	24.4	7525	29.4	1575	29.8	18	9118	29.5
Total Satisfactory	1743	96.5	342	92.3	15	2100	95.6	24715	96.3	4930	93.3	45	29690	95.7
Unsatisfactory	64	3.5	29	7.7	5	98	4.4	943	3.7	354	6.7	25	1322	4.3
Total	1807		371		20	2198		25658		5284		70	31012	

Table No. 7—Primary Water Supplies to Sprinklers Opened.

	1923-1924		1897-1924, incl.	
	No. of Fires	Per Cent	No. of Fires	Per Cent
Waterworks	1131	51.9	14889	52.4
Gravity Tank	401	18.4	6801	24.0
Pressure Tank	555	25.5	5181	18.3
Pumps	92	4.2	1501	5.3
Steamer Connection	..	..	3	..
Total with data given.....	2179		28375	
No Data	19		559	
Water shut off system.....	..		270	
Total	2198		29204	

Table No. 8

Effect of Sprinklers by Class of Occupancy.

	Extinguished Fire		Held Fire in Check		Total Satisfactory.		Unsatisfactory.		Total No. of Fires.
	No.	%	No.	%	No.	%	No.	%	
Agricultural Implements	53	58.3	34	37.2	87	95.5	4	4.5	91
Alcohol (Wood) Plant	..	....	1	100.0	1	100.0	..	..	1
Apartments	21	95.5	1	4.5	22	100.0	..	..	22
Artificial Leather	14	48.3	13	44.8	27	93.1	2	6.9	29
Automobile and Bicycle Factories	122	57.8	78	37.0	200	94.8	11	5.2	211
Awning Factories	6	75.0	2	25.0	8	100.0	..	..	8
Bag Factories	15	51.6	14	48.4	29	100.0	..	..	29
Bakeries	74	72.5	25	24.5	99	97.0	3	3.0	102
Basket Factories	7	87.5	1	12.5	8	100.0	..	..	8
Bolt, Nut and Screw Works	17	65.5	9	34.5	26	100.0	..	..	26
Boot and Shoe Shops	621	73.5	194	22.9	815	96.4	31	3.6	846
Bottle Caps and Seals	12	54.5	10	45.5	22	100.0	..	..	22
Bottling Works	5	83.4	..	....	5	83.4	1	16.6	6
Braiding Mills	19	79.3	4	16.6	23	95.9	1	4.1	24
Breweries	5	83.4	1	16.6	6	100.0	..	..	6
Broom Factories	10	58.7	5	29.4	15	88.1	2	11.9	17
Brush Factories	19	73.1	7	26.9	26	100.0	..	..	26
Button Factories	50	82.0	9	14.7	59	96.7	2	3.3	61
Candle Factories	5	41.6	7	58.4	12	100.0	..	..	12
Candy Factories	122	70.5	46	26.6	168	97.1	5	2.9	173
Canning Factories	10	55.5	5	27.9	15	83.4	3	16.6	18
Car Houses	30	46.9	27	42.2	57	89.1	7	10.9	64
Car Works	76	61.3	43	34.7	119	96.0	5	4.0	124
Carpet Mills	166	61.7	93	34.6	259	96.3	10	3.7	269
Carriage and Automobile Body Factories	109	61.0	53	29.6	162	90.6	17	9.4	179
Celluloid (Pyroxylin Plastic)	147	67.6	45	20.8	192	88.4	25	11.6	217
Cement and Plaster Works	5	62.5	2	25.0	7	87.5	1	12.5	8
Cereal Mills	33	63.5	12	23.0	45	86.5	7	13.5	52
Chemical and White Lead	103	58.5	57	32.4	160	90.9	16	9.1	176
Clothing Factories	1133	83.4	208	15.8	1341	99.2	11	.8	1352
Clubs	7	70.0	2	20.0	9	90.0	1	10.0	10
Coffee and Spice Mills	52	65.8	23	29.1	75	94.9	4	5.1	79
Coffin Factories	55	75.3	16	21.9	71	97.2	2	2.8	73
Cold Storage Plants	6	50.0	6	50.0	12	100.0	..	..	12
Cooperage Plants	47	55.3	27	31.8	74	87.1	11	12.9	85
Cordage Works	217	65.2	104	31.2	321	96.4	12	3.6	333
Cork Factories	16	47.0	14	41.2	30	88.2	4	11.8	34
Corset Factories	10	71.4	3	21.4	13	92.8	1	7.2	14
Cotton Ginnery	10	62.5	6	37.5	16	100.0	..	..	16
Cotton Mills	4088	62.2	2413	36.7	6501	98.9	76	1.1	6577
Cotton Warehouses	147	46.3	145	45.5	292	91.8	26	8.2	318
Cotton Seed Oil Mills	39	47.6	29	35.4	68	83.0	14	17.0	82
Cutlery and Tools	25	64.0	12	30.8	37	94.8	2	5.2	39
Department Stores	422	78.5	100	18.6	522	97.1	16	2.9	538
Distilleries	7	63.7	3	27.2	10	90.9	1	9.1	11
Doll Factories	31	59.6	21	40.4	52	100.0	..	..	52
Drug Houses	178	80.6	39	17.6	217	98.2	4	1.8	221
Dry Cleaning Establishments	7	70.0	3	30.0	10	100.0	..	..	10
Dry Goods Stores	180	84.1	33	15.4	213	99.5	1	.5	214
Dyeing, Bleaching and Finishing	154	54.4	116	41.0	270	95.4	13	4.6	283
Electrical Appliances	165	70.5	63	26.9	228	97.4	6	2.6	234
Electric Light and Power Plants	4	30.8	7	53.9	11	84.7	2	15.3	13
Elevators, Grain	28	38.8	26	36.2	54	75.0	18	25.0	72
Excelsior Factories	25	75.7	5	15.1	30	90.8	3	9.2	33
Fertilizer Plants	25	62.5	11	27.5	36	90.0	4	10.0	40
Flax and Linen Mills	26	45.6	31	54.4	57	100.0	..	..	57

Table No. 8 — Continued.

	Extinguished Fire		Held Fire in Check		Total Satisfactory.		Unsatisfactory.		Total No. of Fires.
	No.	%	No.	%	No.	%	No.	%	
Flour and Grist Mills	62	57.4	35	32.4	97	89.8	11	10.2	108
Forge and Smithy	16	69.6	6	26.1	22	95.7	1	4.3	23
Foundries	158	57.5	104	37.8	262	95.3	13	4.7	275
Fur Works	34	91.8	3	8.2	37	100.0	..	..	37
Furniture Factories	552	64.8	234	27.5	786	92.3	65	7.7	851
Furniture Stores	40	74.1	10	18.5	50	92.6	4	7.4	54
Garages	169	69.0	70	28.6	239	97.6	6	2.4	245
Garbage Reduction Plants	3	60.0	1	20.0	4	80.0	1	20.0	5
Gas Plants	2	66.7	1	33.3	3	100.0	..	..	3
General Stores	12	75.0	4	25.0	16	100.0	..	..	16
Glass Works	52	53.6	35	36.1	87	89.7	10	10.3	97
Glove Factories	10	71.4	3	21.4	13	92.8	1	7.2	14
Glue Factories	6	50.0	4	25.0	10	75.0	2	25.0	12
Groceries	98	81.6	17	14.2	115	95.8	5	4.2	120
Hardware Stores	67	86.0	10	12.8	77	98.8	1	1.2	78
Harness and Fancy Leather	112	84.8	20	15.2	132	100.0	..	..	132
Hat Factories	171	75.7	47	20.8	218	96.5	8	3.5	226
Hatters' Fur Works	12	50.0	9	37.5	21	87.5	3	12.5	24
Hotels	29	76.3	8	21.1	37	97.4	1	2.6	38
Ice Plants	2	100.0	..	....	2	100.0	..	..	2
Incandescent Lamp Works	17	58.6	12	41.4	29	100.0	..	..	29
Institutions	9	69.1	3	23.2	12	92.3	1	7.7	13
Insulated Wire Factories	31	66.0	16	34.0	47	100.0	..	..	47
Jewelry Factories	135	85.8	16	10.4	151	96.2	6	3.8	157
Junk Shops	18	75.0	5	20.8	23	95.8	1	4.2	24
Knitting Mills, Cop Yarn	50	66.7	19	25.4	69	92.1	6	7.9	75
Knitting Mills, Full Process	487	64.6	242	32.1	729	96.7	25	3.3	754
Laundries	59	72.0	20	24.4	79	96.4	3	3.6	82
Lead Pencil Factories	16	66.7	7	29.2	23	95.9	1	4.1	24
Linseed Oil Works	17	53.1	11	34.4	28	87.5	4	12.5	32
Machine Works	362	67.8	146	27.3	508	95.1	26	4.9	534
Match Factories	53	74.6	14	19.7	67	94.3	4	5.7	71
Mattress Factories	364	69.6	150	28.7	514	98.3	9	1.7	523
Mercantile (Miscellaneous)	615	79.7	137	17.8	752	97.5	19	2.5	771
Metal Reduction Works	10	66.7	5	33.3	15	100.0	..	..	15
Metal Workers	877	65.0	416	30.8	1293	95.8	57	4.2	1350
Miscellaneous	494	72.7	151	22.2	645	94.9	34	5.1	679
Morocco Leather Shops	36	53.0	23	33.8	59	86.8	9	13.2	68
Motion Pictures	61	80.3	14	18.4	75	98.7	1	1.3	76
Munition Factories	22	41.5	22	41.5	44	83.0	9	17.0	53
Musical Instrument Factories	119	66.8	53	29.8	172	96.6	6	3.4	178
Office Buildings	32	86.5	5	13.5	37	100.0	..	..	37
Oil Clothing Factories	11	68.8	5	31.2	16	100.0	..	..	16
Oilcloth and Linoleum Works	36	31.0	60	51.7	96	82.7	20	17.3	116
Oil Refineries									
Animal	2	40.0	3	60.0	5	100.0	..	..	5
Mineral	5	83.4	1	16.6	6	100.0	..	..	6
Vegetable	1	14.3	5	71.4	6	85.7	1	14.3	7
Packing House and Slaughter	141	69.8	53	26.2	194	96.0	8	4.0	202
Paint and Varnish Works	188	67.4	80	28.7	268	96.1	11	3.9	279
Paper Box and Papeterie	181	76.0	52	21.8	233	97.8	5	2.2	238
Paper Mills	384	49.7	325	42.1	709	91.8	63	8.2	772
Patent Leather Works	11	40.7	12	44.5	23	85.2	4	14.8	27
Phonograph Works	19	76.0	5	20.0	24	96.0	1	4.0	25
Photographic Works	27	75.0	8	22.2	35	97.2	1	2.8	36
Picture Frame Factories	43	66.1	16	24.6	59	90.7	6	9.3	65
Plumbers' Supplies	20	80.5	5	20.0	25	100.0	..	..	25
Potteries	45	63.4	21	29.6	66	93.0	5	7.0	71
Printing and Lithographing	642	80.2	140	17.5	782	97.7	18	2.3	800
Public Buildings	..	..	1	100.0	1	100.0	..	..	1

Table No. 8 — Concluded.

	Extinguished Fire		Held Fire in Check		Total Satisfactory.		Unsatisfactory.		Total No. of Fires.
	No.	%	No.	%	No.	%	No.	%	
Pulp Mills	30	33.7	39	44.1	69	77.8	20	22.2	89
Restaurants	45	83.3	8	14.8	53	98.1	1	1.9	54
Rice Mills	2	66.7	1	33.3	3	100.0	..	..	3
Rolling, Wire and Tube Works	27	56.3	18	37.5	45	93.8	3	6.2	48
Roofing Works	27	40.3	34	50.7	61	91.0	6	9.0	67
Rubber Cloth Factories	26	60.5	17	39.5	43	100.0	..	..	43
Rubber Reclaiming Works	6	33.3	9	50.0	15	83.3	3	16.7	18
Rubber Works	143	50.3	123	43.3	266	93.6	18	6.4	284
Saw and Planing Mills	84	43.6	64	33.2	148	76.8	45	23.2	193
Schools	9	75.0	3	25.0	12	100.0	..	..	12
Ships and Shipbuilding	5	45.5	6	54.5	11	100.0	..	..	11
Shirt Factories	51	86.5	8	13.5	59	100.0	..	..	59
Shoddy Mills	203	65.0	89	28.3	292	93.3	21	6.7	313
Shoe Stores	33	84.5	6	15.5	39	100.0	..	..	39
Silk Mills	80	74.1	24	22.2	104	96.3	4	3.7	108
Skin Mills	5	83.3	1	16.7	6	100.0	..	..	6
Soap Manufacturing	34	79.0	8	18.6	42	97.6	1	2.4	43
Stamping and Sheet Metal Works	66	62.3	33	31.1	99	93.4	7	6.6	106
Starch and Glucose Works	12	52.3	4	17.4	16	69.7	7	30.3	23
Sticky Fly Paper Factories	3	75.0	1	25.0	4	100.0	..	..	4
Sugar Refineries	23	57.5	16	40.0	39	97.5	1	2.5	40
Tanneries	43	52.5	32	39.0	75	91.5	7	8.5	82
Tenant Manufacturing	693	74.3	192	20.6	885	94.9	48	5.1	933
Theatres	52	75.3	14	20.4	66	95.7	3	4.3	69
Tobacco Factories	58	72.5	19	23.7	77	96.2	3	3.8	80
Trunk Factories	19	70.4	6	22.2	25	92.6	2	7.4	27
Wall Paper Factories	17	70.8	4	16.7	21	87.5	3	12.5	24
Warehouses	360	71.1	122	24.2	482	95.3	24	4.7	506
Waste and Batting Mills	261	60.4	155	35.8	416	96.2	17	3.8	433
Waste Paper and Rag Shops	79	64.2	41	33.4	120	97.6	3	2.4	123
Weaving Mills	120	66.7	56	31.1	176	97.8	4	2.2	180
Whip Factories	4	66.7	2	33.3	6	100.0	..	..	6
Window Shade Factories	10	83.4	..	....	10	83.4	2	16.6	12
Woodworkers, Class A*	152	54.6	87	31.3	239	85.9	39	14.1	278
Woodworkers, Class B*	150	51.9	110	38.1	260	90.0	29	10.0	289
Woodworkers, Class C*	128	60.4	74	34.9	202	95.3	10	4.7	212
Woodworkers, Class D*	89	57.0	48	30.8	137	87.8	19	12.2	156
Woodworkers, Class E*	155	64.3	75	31.1	230	95.4	11	4.6	241
Woodworkers, Class F*	35	60.4	19	32.8	54	93.2	4	6.8	58
Woolen Mills	920	70.0	333	25.3	1253	95.3	63	4.7	1316
Wool Storehouses	28	70.0	10	25.0	38	95.0	2	5.0	40
Worsted Mills	59	52.7	39	34.8	98	87.5	14	12.5	112
Total Sprinkler Fires	20,573		9,114		29,687		1,325		31,012

*The Woodworkers are classed as follows:

Class A. Interior Woodwork, builders' supplies (including veneer works).

Class B. Box Factories (including cigar boxes).

Class C. Miscellaneous Woodworkers. Steam power tenant Woodworkers. Woodworkers where there is a lack of detailed information as to class.

Class D. Sash, Door and Blind Factories.

Class E. Hard Wood Turning (wheels, pipes, novelties, bobbins, spools, etc., last and wood heel factories)

Class F. Pails and Woodenware (Plates, wooden bowls, tubs, etc.)

Table No. 9

Classification of Unsatisfactory Sprinkler Fires by Occupancy.

	Water shut off sprinklers.	Generally defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Sprinkler system crippled by explosion.	Exposure or conflagration.	Plugged Heads.	Miscellaneous.	Total.
Agricultural Implements	3	..	..	..	..	..	..	..	1	..	..	..	..	4
Artificial Leather	..	..	..	..	..	..	1	..	..	1	..	..	..	2
Automobile and Bicycle	5	1	1	..	..	..	..	3	..	..	1	..	..	11
Bakeries	1	1	..	..	..	..	..	..	..	..	..	..	1	3
Boot and Shoe Shops	12	6	2	..	..	1	..	1	..	2	5	..	2	31
Bottling Works	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Braid Mill	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Broom Factories	2	..	..	..	..	..	..	..	..	..	..	..	..	2
Button Factories	..	..	..	2	..	..	..	..	..	..	..	..	..	2
Candy Factories	2	..	..	..	1	..	2	..	..	..	..	..	..	5
Canning Works	1	..	..	..	1	..	..	..	..	..	1	..	..	3
Car Houses	2	2	1	..	1	..	..	1	..	..	..	..	..	7
Car Works	2	1	..	..	..	..	1	1	..	..	..	..	..	5
Carpet Mills	4	2	3	..	..	..	..	1	..	..	..	..	..	10
Carriage Factories	3	4	3	..	2	..	..	1	1	..	2	1	..	17
Celluloid (Pyroxylin)	1	..	3	1	1	..	2	2	8	5	2	..	..	25
Cement and Plaster Works	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Cereal Mills	..	2	1	..	..	..	..	1	..	3	..	..	..	7
Chemical and White Lead	2	4	..	..	..	..	..	..	4	5	..	..	1	16
Clothing Factories	3	..	2	1	..	..	2	2	..	..	1	..	..	11
Clubs	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Coffee and Spice Mills	2	..	..	..	..	..	..	1	..	1	..	..	..	4
Coffin Factories	1	..	..	1	..	..	..	..	..	..	..	..	..	2
Cooperage Plants	1	4	..	..	..	1	..	4	..	..	1	..	..	11
Cordage Works	3	4	1	1	..	..	..	2	..	..	..	..	1	12
Cork Factories	1	..	1	..	..	..	..	..	..	1	..	..	1	4
Corset Factories	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Cotton Mills	25	21	6	2	..	1	5	1	3	..	..	2	10	76
Cotton Warehouses	14	1	2	..	..	..	1	4	2	..	..	..	2	26
Cotton Seed Oil Mills	3	5	2	..	..	..	..	..	1	..	..	..	3	14
Cutlery and Hardware	1	1	..	..	..	..	..	..	..	..	..	..	..	2
Department Stores	6	4	..	..	1	..	1	1	..	..	2	..	1	16
Distilleries	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Drug Houses	..	..	..	..	..	..	..	..	..	..	3	..	1	4
Dry Goods Stores	..	..	..	..	..	..	..	1	..	..	..	..	..	1
Dyeing, Bleaching and Finishing	4	3	1	..	1	1	..	1	..	..	1	..	1	13
Electrical Appliances	2	..	2	..	..	..	1	..	..	..	..	..	1	6
Electric Light and Power Plants	..	1	..	..	..	..	..	1	..	..	..	..	..	2
Elevators, Grain	..	3	5	..	2	..	2	1	1	1	2	..	1	18
Excelsior Factories	..	..	2	..	..	..	..	..	1	..	..	..	..	3
Fertilizer Plants	2	1	..	..	1	..	..	..	..	..	..	..	..	4
Flour and Grist Mills	1	2	1	..	1	..	1	..	..	3	2	..	..	11
Forge and Smithy	..	..	..	..	..	..	..	1	..	..	..	..	..	1

Table No. 9—Continued.

	Water shut off sprinklers.	Generally defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Sprinkler system crippled by explosion.	Exposure or conflagration.	Plugged Heads.	Miscellaneous.	Total.
Foundries	10	1	1	..	..	..	..	..	..	1	..	..	..	13
Furniture Factories	20	15	2	3	..	..	3	9	7	..	4	2	..	65
Furniture Stores	4	..	..	..	..	..	..	..	..	..	..	..	..	4
Garages	4	..	..	..	..	..	..	2	..	..	..	..	..	6
Garbage Reduction Plants	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Glass Works	1	1	2	1	..	..	1	1	..	..	..	..	3	10
Glove Factories	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Glue Factories	1	..	..	..	..	..	..	..	1	..	..	..	..	2
Groceries	3	..	1	..	1	..	..	..	..	..	..	..	..	5
Hardware Stores	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Hat Factory	2	3	1	..	1	..	..	1	..	..	..	..	..	8
Hatters' Fur Mfg	2	..	..	..	..	..	1	..	..	..	..	..	..	3
Hotels	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Institutions	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Jewelry Shops	2	1	..	2	..	..	1	..	..	..	..	..	..	6
Junk Shops	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Knitting, Cop Yarn	..	1	3	..	..	..	..	1	..	1	..	..	..	6
Knitting, Full Process	7	9	5	1	1	..	1	..	..	1	..	..	..	25
Laundries	2	..	..	..	..	..	..	1	..	..	..	..	..	3
Lead Pencil Works	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Linseed Oil Works	1	..	..	..	..	..	..	..	..	2	..	..	1	4
Machine Shops	15	5	1	1	..	1	..	1	..	1	..	..	1	26
Match Factories	2	..	..	..	..	..	..	..	1	..	..	..	1	4
Mattress Factories	4	2	..	1	..	..	..	2	..	..	..	..	..	9
Mercantile (Miscel.)	6	2	1	2	..	..	3	..	..	..	4	..	1	19
Metal Workers	18	13	2	..	..	1	5	3	4	2	2	2	5	57
Miscellaneous	8	6	3	1	1	2	2	1	4	2	2	..	2	34
Morocco Leather Shops.	3	3	..	..	1	..	1	..	..	..	..	..	1	9
Motion Pictures	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Munitions Factories	2	..	..	1	..	..	..	..	4	1	..	..	1	9
Musical Instrument Factories	1	3	..	..	..	..	1	..	..	..	1	..	..	6
Oilcloth and Linoleum Works	..	5	..	..	..	..	1	3	11	..	..	..	..	20
Oil Refinery (Vegetable)	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Packing House and Slaughter	1	2	1	..	2	..	..	..	1	..	..	..	1	8
Paint and Varnish Works	1	2	4	..	..	..	3	..	1	..	..	..	..	11
Paper Box and Papeterie	4	1	..	..	..	..	..	..	..	..	..	..	..	5
Paper Mills	13	19	6	3	1	2	2	..	3	1	2	1	10	63
Patent Leather Works	1	..	1	1	..	..	1	..	..	..	..	..	..	4
Phonograph Works	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Photograph Works	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Picture Frame Factories	1	2	1	1	..	..	..	1	..	..	..	..	..	6
Potteries	1	1	1	1	..	..	..	..	..	1	..	..	..	5
Printing and Lithographing	7	4	1	..	..	..	1	1	..	..	3	..	1	18
Pulp Mills	7	3	4	..	1	1	1	..	1	1	..	..	1	20
Restaurants	..	..	..	..	..	..	1	..	..	..	..	..	..	1

Table No. 9—Concluded.

	Water shut off sprinklers.	Generally defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to Distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Sprinkler system crippled by explosion.	Exposure or conflagration.	Plugged Heads.	Miscellaneous.	Total.
Rolling, Wire and Tube Works	..	..	..	..	..	1	1	..	..	..	..	..	1	3
Roofing Works	2	2	..	1	..	..	..	..	..	1	..	..	..	6
Rubber Reclaiming Works	1	..	..	..	..	..	1	..	..	1	..	..	..	3
Rubber Works	6	..	..	1	..	..	..	1	5	3	..	1	1	18
Saw and Planing Mills	11	8	1	..	4	1	6	2	4	..	5	1	2	45
Shoddy Mills	6	3	6	..	1	3	..	1	..	..	..	..	1	21
Silk Mills	2	1	..	..	..	..	..	..	..	1	..	..	..	4
Soap Manufacturing	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Stamping and Sheet Metal Works	1	2	1	..	1	..	..	..	..	..	2	..	..	7
Starch and Glucose Mills	..	..	..	..	..	..	..	..	1	6	..	..	..	7
Sugar Refineries	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Tanneries	1	1	..	3	..	..	..	..	..	..	1	..	1	7
Tenant Manufacturing	23	7	2	2	1	..	2	1	1	..	6	..	3	48
Theatres	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Tobacco Factories	1	1	..	..	..	..	..	..	..	..	1	..	..	3
Trunk Factories	1	1	..	..	..	..	..	..	..	..	..	..	..	2
Wall Paper Factories	..	..	1	..	..	..	..	1	..	..	1	..	..	3
Warehouses	10	3	1	..	2	..	1	3	..	..	..	..	4	24
Waste and Batting Mills	4	4	3	1	..	1	..	1	2	..	..	..	1	17
Waste Paper and Rag Shops	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Weaving Mills	1	1	1	1	..	..	..	..	..	..	..	..	..	4
Window Shade Factories	..	..	..	1	..	..	..	..	1	..	..	..	..	2
Woodworkers, Class A*	10	9	2	..	1	1	..	6	..	3	3	1	3	39
Woodworkers, Class B*	6	8	2	2	..	2	1	1	..	3	2	..	2	29
Woodworkers, Class C*	3	4	1	..	..	..	..	2	..	..	..	..	..	10
Woodworkers, Class D*	1	7	..	1	1	..	..	..	..	2	4	..	3	19
Woodworkers, Class E*	3	2	..	..	2	1	2	..	..	..	1	..	..	11
Woodworkers, Class F*	2	..	1	..	..	..	..	1	..	..	..	..	..	4
Woolen Mills	16	16	12	1	..	2	4	..	1	..	3	..	8	63
Wool Storehouses	..	2	..	..	..	..	..	..	..	..	..	..	..	2
Worsted Mills	3	3	2	1	..	..	1	..	..	..	..	..	4	14
Total Unsatisfactory Fires	388	267	118	42	36	23	68	78	75	58	72	11	89	1325

*See detailed classification of woodworkers as given in note under Table No. 8.

Table 10.

Secondary Water Supplies to Sprinkler System.

Occupancy	Total No. of Fires	Secondary Supply: When a Factor	Secondary Supply: % Total	Primary Supply: Waterworks	Primary Supply: Gravity Tank	Primary Supply: Pressure Tank	Primary Supply: Misc. Pumps†	Secondary Supply: Waterworks	Secondary Supply: Gravity Tank	Secondary Supply: Pressure Tank	Secondary Supply: Steam Pump	Secondary Supply: Misc. Pumps†	Secondary Supply: Steamer Connection
Agricultural Implements	91	3	3.3	3	..	..	..	..	..	..	2	1	..
Auto and Bicycle Fac. .	211	8	3.8	3	2	1	2	2	3	..	2	1	..
Bag Factories	29	2	6.9	..	..	2	..	..	2	..	..	..	..
Bakeries	102	1	1.0	1	..	..	..	..	1	..	..	..	..
Bolt, Nut and Screw Works	26	2	7.7	1	..	..	1	1	..	..	1	..	..
Boot and Shoe Shops ...	846	15	1.8	9	3	3	..	2	7	1	3	2	..
Bottle Caps and Seals ..	22	1	4.5	..	1	..	..	..	..	..	1	..	..
Broom Factories.....	17	1	5.9	1	..	..	..	..	1	..	..	..	..
Button Factories	61	1	1.6	..	..	1	..	..	1	..	..	..	..
Candle Factories	12	1	8.3	..	..	1	..	..	1	..	..	..	..
Candy Factories.....	173	5	2.9	1	..	4	..	3	1	..	..	..	1
Car Houses	64	1	1.6	1	..	..	..	..	1	..	..	..	..
Car Works	124	3	2.4	2	1	..	..	..	..	..	3	..	..
Carpet Mills.....	269	8	3.0	5	3	..	..	1	..	..	6	1	..
Carriage Factories.....	179	17	9.5	10	2	5	..	2	8	..	3	3	1
Celluloid Works.....	217	16	7.4	13	1	2	..	..	6	..	8	1	1
Cement and Plaster.....	8	3	37.5	..	2	1	..	..	1	..	1	1	..
Cereal Mills	52	4	7.7	2	..	2	..	..	..	1	1	2	..
Chemical and White Lead.....	176	19	10.8	4	13	1	1	..	2	1	11	3	2
Clothing	1352	28	2.1	1	..	27	..	2	22	1	1	2	..
Coffee and Spice Mills..	79	1	1.3	..	..	1	..	..	1	..	..	..	..
Coffin Factories	73	2	2.7	..	1	1	..	..	1	..	1	..	..
Cooperage Plants.....	85	6	7.1	1	..	5	..	3	3	..	..	..	..
Cordage Works.....	333	36	10.8	14	6	14	2	11	5	..	12	6	2
Cork Factories	34	2	5.9	..	1	1	..	..	1	..	1	..	..
Corset Factories	14	1	7.1	1	..	..	..	..	1	..	..	..	..
Cotton Mills.....	6577	401	6.1	72	321	7	1	4	9	..	277	111	..
Cotton Warehouses.....	318	24	7.6	7	17	..	..	1	4	..	15	4	..
Cotton Seed Oil Mills...	82	17	20.8	1	14	1	1	1	1	..	12	3	..
Department Stores	538	11	2.2	2	3	6	..	..	5	1	1	3	1
Distilleries	11	3	27.2	..	1	1	1	1	..	1	1	..	..
Doll Factories.....	52	1	1.9	..	..	1	..	..	1	..	..	..	..
Drug Houses.....	221	10	4.5	5	..	5	..	..	7	..	1	..	2
Dry Goods Stores.....	214	4	1.9	1	..	3	..	..	2	..	..	1	1
Dyeing, Bleaching and Finishing	283	7	2.5	3	4	..	..	1	..	..	5	1	..
Electrical Appliances ...	234	5	2.1	3	..	2	..	1	..	..	3	1	..
Electric Light and Power	13	1	7.7	..	1	..	..	..	..	..	1	..	..
Elevators, Grain	72	17	23.6	2	5	8	2	2	1	..	8	6	..
Fertilizer Plants.....	40	7	17.5	1	2	3	1	1	2	..	3	1	..
Flour Mills	108	10	9.2	2	4	4	..	3	1	..	3	2	1
Foundries	275	7	2.6	4	2	1	..	1	2	..	4	..	..
Furniture Factories.....	851	54	6.4	26	9	18	1	11	19	..	16	5	3
Furniture Stores.....	54	3	5.6	1	..	2	..	1	2	..	..	..	..
Garages.....	245	4	1.6	..	1	3	..	1	3	..	..	..	..
Glass Works.....	97	6	6.2	3	1	2	..	..	3	..	1	2	..

Table 10 — Continued.

Secondary Water Supplies to Sprinkler System.

Occupancy	Total No. of Fires	Secondary Supply: When a Factor	Secondary Supply: % Total	Primary Supply: Waterworks	Primary Supply: Gravity Tank	Primary Supply: Pressure Tank	Primary Supply: Misc. Pumps†	Secondary Supply: Waterworks	Secondary Supply: Gravity Tank	Secondary Supply: Pressure Tank	Secondary Supply: Steam Pump	Secondary Supply: Misc. Pumps†	Secondary Supply: Steamer Connection
Glove Factories	14	1	7.1	1	..	..	..	1	..	..	..	..	..
Glue Factories	12	3	25.0	..	3	..	..	..	..	..	3	..	..
Groceries	120	2	1.7	2	..	..	..	..	2	..	..	..	.
Harness and Fancy Leather	132	6	4.5	..	..	6	..	..	5	..	..	..	1
Hat Factories	226	10	4.4	3	3	4	..	1	3	1	4	..	1
Hatters' Fur Mfg.	24	1	4.2	1	..	..	..	..	1	..	..	..	..
Inc. Lamp Factories	29	1	3.5	..	1	..	..	1	..	..	..	..	..
Insulated Wire Factories	47	2	4.3	..	2	..	..	..	..	..	2	..	..
Junk Shops	24	2	8.3	1	..	1	..	..	2	..	..	..	..
Knitting Mills, Cop Yarn	75	2	2.7	..	2	..	..	..	..	..	1	1	..
Knitting Mills, F. P.	754	27	3.6	6	20	1	..	1	1	..	12	13	..
Linseed Oil Works	32	6	18.7	..	2	3	1	..	..	1	1	4	..
Machine Shops	534	12	2.2	1	4	7	..	2	2	..	7	1	..
Match Factories	71	4	5.6	..	1	1	2	3	..	..	..	1	..
Mattress Factories	523	19	3.6	2	9	8	..	4	4	..	9	..	2
Mercantile Miscellaneous	771	30	3.9	3	1	24	2	12	7	1	..	3	7
Metal Workers	1350	42	3.1	19	11	9	3	6	9	1	22	3	1
Miscellaneous	679	32	4.7	14	6	9	3	2	14	1	10	5	..
Morocco Leather	68	3	4.4	3	..	..	..	..	..	..	2	1	..
Motion Picture	76	3	3.9	1	1	1	..	..	1	1	1	..	..
Munition Factories	53	9	9.4	..	9	..	..	..	..	..	9	..	..
Musical Instrument Factories	178	9	5.1	2	2	4	1	..	7	..	1	1	..
Office Buildings	37	2	5.4	1	1	..	..	1	1	..	..	..	..
Oil Clothing Factories	16	1	6.3	..	..	1	..	1	..	..	..	..	..
Oil Cloth and Linoleum	116	41	35.3	9	29	..	3	4	4	..	26	7	..
Oil Refineries (Vegetable)	7	2	28.6	..	1	1	..	1	..	..	1	..	..
Packing House	202	11	5.5	6	3	2	..	2	1	..	3	4	1
Paint and Varnish Works	279	13	4.7	2	3	8	..	4	3	..	5	1	..
Paper Box	238	8	3.4	2	2	4	..	2	3	..	1	..	2
Paper Mills	772	70	9.1	25	39	1	5	3	2	..	48	17	..
Phonograph Works	27	1	3.7	..	..	1	..	..	1	..	..	..	..
Photographic Works	36	1	2.8	..	1	..	..	..	..	..	1	..	..
Picture Frames	65	4	6.2	..	1	3	..	..	2	1	1	..	..
Plumbers' Supplies	25	2	8.0	1	..	1	..	..	2	..	..	..	..
Potteries	71	3	4.2	..	1	..	2	..	2	..	1	..	..
Printing	800	10	1.3	3	3	4	..	2	6	..	1	..	1
Pulp Mills	89	13	14.6	8	3	1	1	1	..	..	11	1	..
Restaurants	54	1	1.8	..	..	1	..	..	1	..	..	..	..
Rolling, Wire and Tube Works	48	2	4.2	1	1	..	..	..	..	..	1	1	..
Roofing Works	67	10	14.9	5	5	..	..	..	3	..	6	..	1
Rubber Cloth Factories	43	2	4.6	1	1	..	..	..	..	..	1	1	..
Rubber Reclaiming Works	18	3	16.7	1	2	..	..	..	..	..	3	..	..

Table 10 — Concluded.

Secondary Water Supplies to Sprinkler System.

Occupancy	Total No. of Fires	Secondary Supply: When a Factor	Secondary Supply: % Total	Primary Supply: Waterworks	Primary Supply: Gravity Tank	Primary Supply: Pressure Tank	Primary Supply: Misc. Pumps†	Secondary Supply: Waterworks	Secondary Supply: Gravity Tank	Secondary Supply: Pressure Tank	Secondary Supply: Steam Pump	Secondary Supply: Misc. Pumps†	Secondary Supply: Steamer Connection
Rubber Works	284	12	4.2	3	7	2	..	1	..	..	5	5	1
Saw and Planing Mills	193	38	19.7	17	12	..	9	2	8	..	19	8	1
Schools	12	1	8.3	1	..	..	..	..	..	..	..	1	..
Ships and Shipbuilding	11	2	18.2	2	..	..	..	..	1	..	1	..	..
Shirt Factories	59	1	1.7	1	..	..	..	..	..	..	..	1	..
Shoddy Mills	313	16	5.1	11	3	1	1	..	4	..	9	3	..
Silk Mills	108	1	.9	..	..	1	..	..	1	..	..	..	..
Skin Mills	6	1	16.7	1	..	..	..	..	..	..	..	1	..
Soap Manufacturing	43	2	4.6	1	1	..	..	1	..	1	..	..	..
Stamping and Sheet Metal Works	106	8	7.5	4	3	1	..	2	3	..	3	..	..
Sugar Refineries	40	1	2.5	1	..	..	..	..	..	..	1	..	..
Tanneries	82	5	6.1	4	..	1	..	..	..	..	4	..	1
Tenant Manufacturing	933	15	1.6	1	2	10	2	1	9	2	3	..	..
Wall Paper Factories	24	3	12.5	1	2	..	..	..	1	..	2	..	..
Warehouses	506	28	5.5	9	9	7	3	4	14	..	7	3	..
Waste and Batting Mills	433	17	3.9	8	3	6	..	3	4	..	3	4	3
Waste Paper and Rags	123	4	3.3	..	..	4	..	3	1	..	..	..	..
Weaving Mills	180	7	3.9	..	7	..	..	..	..	..	4	3	..
Woodworkers, Class A*	278	16	5.8	10	2	3	1	1	5	1	4	4	1
Woodworkers, Class B*	289	19	6.6	6	6	6	1	2	8	..	4	3	2
Woodworkers, Class C*	212	9	4.2	2	4	..	3	..	5	..	2	2	..
Woodworkers, Class D*	156	8	5.1	6	..	..	2	1	5	..	1	1	..
Woodworkers, Class E*	241	5	2.1	3	1	1	..	..	1	..	..	4	..
Woodworkers, Class F*	58	6	10.3	3	2	1	..	2	1	..	2	1	..
Woolen Mills	1316	79	6.0	26	44	3	6	2	10	..	31	36	..
Worsted Mills	112	2	1.8	1	1	..	..	..	..	..	2	..	..
Total	29,854	1511		452	703	292	64	135	301	17	709	308	41

*See detailed classification of woodworkers as given in note under Table No. 8.
†See footnote under Table No. 11.

Table No. 11—Secondary Water Supplies to Sprinkler System. 1923-1924.

Primary Supply	No. of Fires where Secondary Supply was a Factor	Secondary Supply: Waterworks	Secondary Supply: Gravity Tank	Secondary Supply: Pressure Tank	Secondary Supply: Steam Pump	Secondary Supply: Misc. Pump†	Secondary Supply: Steamer Connection
Water Works	34	..	12	1	16	4	1
Gravity Tank	27	..	..	..	19	8	..
Pressure Tank	20	2	14	..	1	2	1
Misc. Pumps†	1	..	1	..	..	..	..
Total	82	2	27	1	36	14	2

†Miscellaneous pumps include water supplies reported as automatic steam pump, automatic electric pump, automatic fire pump, fire pump, rotary pump and pump with no designation of type.

SECTION III.

Efficiency of Primary Water Supply.

The following tables show no important change during the past year. As previously the pressure tank as a primary supply shows a greater efficiency than the other forms of primary water supply. Approximately 70 per cent of the 555 fires during the past year in which the pressure tank served as a primary supply were extinguished by one or two sprinkler heads. Public waterworks are by far the most popular form of primary water supply. About 50 per cent of the 11,186 fires in which waterworks were the primary supply have been extinguished with one or two heads.

Table No. 1.

Effect of Sprinklers.

1923-1924.

	W. W.	%	G. T.	%	P.T.	%	Pumps	%	No Data	Total	%
Ext. Fire	741	65.5	272	67.9	485	87.4	59	64.2	8	1565	71.2
Held fire in check	335	29.6	107	26.6	63	11.4	29	31.4	1	535	24.3
Failure	55	4.9	22	5.5	7	1.2	4	4.4	10	98	4.5
Total	1131		401		555		92		19	2198	

1910-1924.

	W. W.	%	G. T.	%	P.T.	%	Pumps	%	No Data	Total	%
Ext. Fire	7177	64.2	2750	63.7	3297	81.2	736	69.3	104	14064	67.4
Held fire in check	3581	32.0	1419	32.9	711	17.5	292	27.4	55	6058	29.1
Failure	428	3.8	145	3.4	50	1.3	35	3.3	66	724	3.5
Total	11186		4314		4058		1063		225	20846	

Table No. 2.

Number of Sprinklers Operating.

1923-1924.

No. of Sprinklers Operating	W. W.	%	G. T.	%	P. T.	%	Pumps	%	No Data	Total	%
1	403	35.9	112	28.2	272	49.0	30	32.6	5	822	37.7
2	203	18.2	63	15.8	120	21.6	17	18.4	4	407	18.7
3	117	10.4	41	10.3	64	11.5	7	7.6		229	10.5
4	74	6.6	27	6.8	42	7.6	10	10.9		153	7.0
5	38	3.4	24	6.0	15	2.7	3	3.2		80	3.7
6	36	3.2	21	5.3	10	1.8	2	2.2	1	70	3.2
7	34	3.0	11	2.8	5	.9	2	2.2		52	2.4
8	26	2.3	17	4.3	4	.7	4	4.4		51	2.3
9	22	2.0	7	1.8	3	.5	1	1.1		33	1.5
10	14	1.2	7	1.8	1	.2				22	1.0
11	7	.6	6	1.5	1	.2				14	.6
12	10	.9	6	1.5	4	.7	2	2.2		22	1.0
13	10	.9	2	.5	1	.2	1	1.1		14	.6
14	9	.8	5	1.3	2	.4	1	1.1		17	.8
15	9	.8	3	.7	1	.2				13	.6
16 to 20	27	2.4	10	2.5	4	.7	3	3.2	1	45	2.1
21 to 25	16	1.4	7	1.8	3	.5	2	2.2		28	1.3
26 to 30	14	1.2	3	.7			2	2.2		19	.9
31 to 35	3	.3	3	.7					1	7	.3
36 to 40	8	.7	3	.7						11	.5
41 to 50	9	.8	2	.5						11	.5
51 to 75	11	1.0	9	2.3	1	.2	3	3.2		24	1.1
76 to 100	5	.5	3	.7	1	.2	1	1.1	1	11	.5
Over 100	17	1.5	6	1.5	1	.2	1	1.1		25	1.2
No Data	9		3						6	18	
Total	1131		401		555		92		19	2198	

Table No. 2—Continued.

Number of Sprinklers Operating.

1910-1924.

No. of Sprinklers Operating	W. W.	%	G. T.	%	P. T.	%	Pumps	%	No. Data	Total	%
1	3568	32.4	1224	28.7	2008	49.6	335	31.8	42	7177	34.9
2	1907	17.3	692	16.2	852	21.1	181	17.2	31	3663	17.9
3	1051	9.5	414	9.7	393	9.7	92	8.7	16	1966	9.5
4	817	7.4	333	7.8	241	5.9	74	7.0	13	1478	7.2
5	491	4.5	204	4.8	120	3.0	43	4.1	9	867	4.2
6	410	3.6	198	4.6	80	2.0	35	3.3	10	733	3.5
7	307	2.8	124	2.9	54	1.3	32	3.0	7	524	2.5
8	292	2.7	121	2.8	35	.9	27	2.5	6	481	2.3
9	195	1.8	72	1.7	28	.7	20	2.0	3	318	1.5
10	181	1.6	64	1.6	24	.6	11	1.1	3	283	1.4
11	113	1.0	57	1.3	21	.5	10	1.0	2	203	1.0
12	156	1.5	77	1.8	20	.5	11	1.1	5	269	1.3
13	93	.8	45	1.1	10	.2	12	1.1	2	162	.8
14	103	.9	40	.9	15	.4	9	.9	2	169	.8
15	86	.8	52	1.2	11	.3	8	.8	1	158	.8
16 to 20.....	302	2.7	120	2.8	31	.8	42	4.0	5	500	2.4
21 to 25.....	207	1.9	83	1.9	19	.5	24	2.3	8	341	1.7
26 to 30.....	135	1.2	60	1.4	14	.3	16	1.5	1	226	1.1
31 to 35.....	78	.7	46	1.1	8	.2	10	1.0	5	147	.7
36 to 40.....	84	.8	39	.9	9	.2	13	1.2	1	146	.7
41 to 50.....	105	.9	44	1.0	14	.3	8	.8	5	176	.9
51 to 75.....	122	1.1	77	1.8	17	.4	14	1.3	4	234	1.1
76 to 100.....	66	.6	24	.6	6	.1	5	.5	5	106	.5
Over 100.....	156	1.5	59	1.4	22	.5	19	1.8	10	266	1.3
No Data	161		45		6		12		29	253	
Total	11186		4314		4058		1063		225	20846	

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